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A STUDY OF THE ESOPHAGUS IN RELATION TO THE HEART, AORTA, AND THORACIC CAGE[1]

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SINCE 1910, roentgenologists have manifested greater interest in the study of the position of the esophagus in the presence of cardio-vascular diseases. Kovacs and Stoerk (1) are apparently the first to introduce the subject, with a study of the position of the esophagus in the presence of cardiac enlargement. After a long interval of silence, there appeared, in 1924, an excellent study of this subject by Gabert (2), who made a detailed analysis of the changes that take place in the position of the esophagus as a result of dilatation of the left auricle. The following year Rosler and Weiss (3) contributed a paper on the position of the esophagus in the presence of enlargement

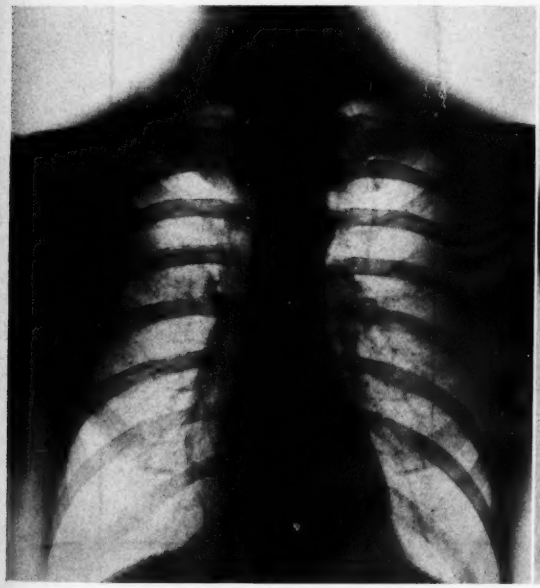

Fig. 1-*A*. The esophagus lies in front of the spine through its entire course. The left border of the esophagus is slightly compressed at the point at which it crosses the arch of the aorta. (Anterior view.)

Fig. 1-*B*. The esophagus lies midway between the anterior and posterior thoracic walls; in the superior mediastinum it lies between the trachea and spine; in the posterior mediastinum, between the heart and descending aorta. (Lateral view.)

[1] Read before the Radiolcgical Society of North America at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

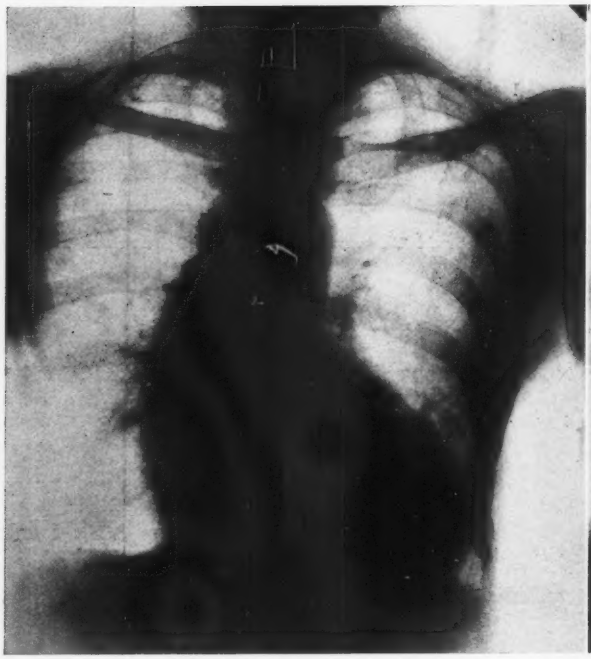

Fig. 2-*A*. The esophagus and heart are displaced to the left. The dorsal spine presents a lateral curvature, with its convex border pointing toward the right. (Anterior view.)

Fig. 2-*B*. The heart and esophagus are displaced backward as a result of the funnel-shaped chest. (Lateral view.)

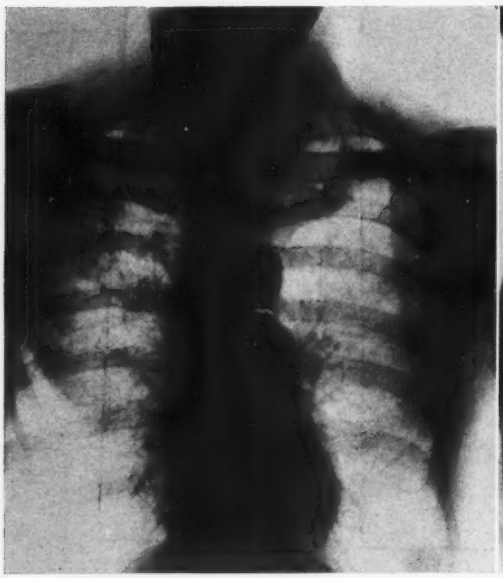

Fig. 3-*A*. The esophagus is in normal position; atheroma of the arch of the aorta; dilatation of the pulmonary artery; pulmonary emphysema. (Anterior view.)

Fig. 3-*B*. The esophagus is in normal position; the sternum is bulging forward; the spine is kyphotic; the distance between the esophagus and the descending aorta is increased. (Lateral view.)

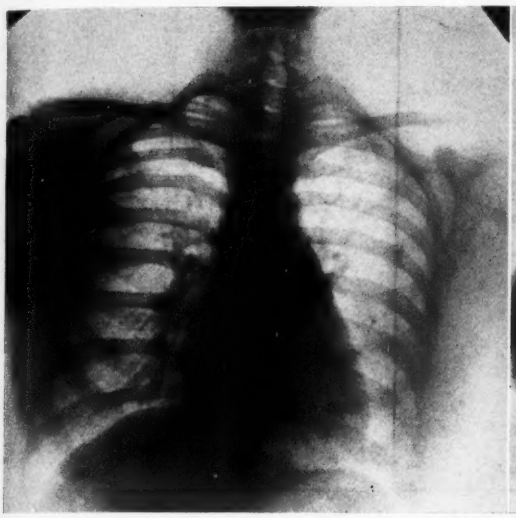

Fig. 4-*A*. The heart presents a mitral configuration. The esophagus is slightly displaced to the right (not seen in the print). (Anterior view.)

Fig. 4-*B*. The segment of the esophagus which is overlapping the left auricle is displaced backward as a result of dilatation of the auricle. (Lateral view.)

of the left auricle. In this country, Rigler published two papers, one (4), in 1929, in which he reported the results of his study of the visualized esophagus in the diagnosis of diseases of the heart and aorta; the other (5), in 1933, dealt with the roentgenologic differentiation of lesions of the right and left heart and their relation to the position of the esophagus. In 1930, Paterson (6) contributed a paper in which he discusses the position of the esophagus and bronchi in the presence of left auricular enlargement.

A review of the above papers reveals a very important omission, namely, the failure to describe the normal position of the heart and aorta and their relation to the esophagus, spine, and thoracic walls in the lateral aspect of the chest. It is quite apparent that, without an accurate knowledge of the exact position and relation of the above structures, no correct interpretation can be made from a change in the position of the esophagus. We also note that the chief interest of the authors consists in the study of the position of the esophagus in the presence of dilatation of the left auricle. In our studies during a period of several years we came across a number of abnormal conditions which may affect the position of the esophagus. It was found that a change in the position of the esophagus does not take place in haphazard manner, but usually follows a certain direction, depending upon the underlying cause. The following abnormal conditions were found to affect the position of the esophagus to a more or less degree:

(1) Thoracic deformities;
(2) Pleuro-pulmonary affections;
(3) Mitral valve lesions;
(4) Aortic valve lesions;
(5) General enlargement of the heart with or without aortic dilatation;
(6) Congenital heart diease;
(7) Dilatation of the aorta with or without aneurysms;
(8) Pericarditis with or without effusions.

The roentgenologic study of the position and relations of the esophagus has received our attention in previous publications (7, 8, and 9). For purposes of completeness, a brief review will be presented.

The esophagus bears a constant relation

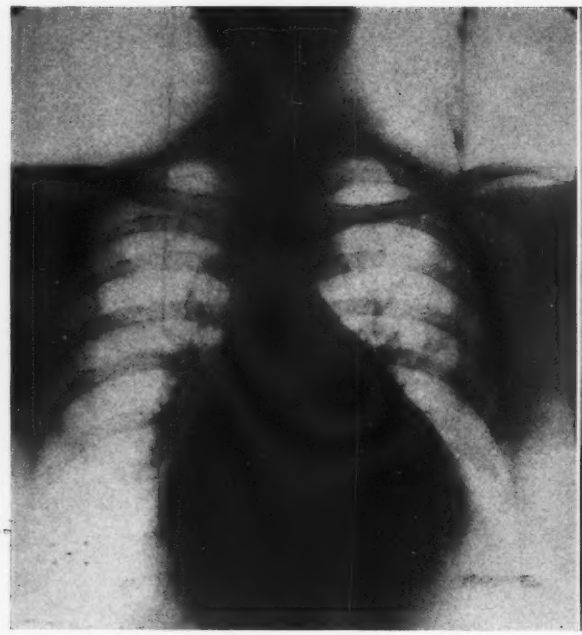

Fig. 5-*A*. Great enlargement of the heart; the esophagus is displaced to the right; the right border of the heart is probably produced by the dilated left auricle. (Anterior view.)

Fig. 5-*B*. The esophagus is displaced backward through its entire course as a result of a general enlargement of all the chambers of the heart. (Lateral view.)

to its neighboring structures: thus, a change in the size, shape, and position of the heart and great blood vessels will produce a change in the size, shape, and position of the esophagus. In the anteroposterior position of the chest (Fig. 1-*A*) the esophagus is located in front of the dorsal spine through its entire course, with the exception of the lower portion which deviates to the left before it enters the cardiac end of the stomach. The following structures are crossed by the esophagus from above downward: the arch of the aorta; the right pulmonary artery; and the right bronchus. In the region of the arch, the left border of the esophagus is slightly compressed. In the lateral position of the chest (Fig. 1-*B*) the esophagus, which is attached to the pericardium by connective tissue, lies behind the trachea in the superior mediastinum and behind the heart in the posterior mediastinum. Between the esophagus and dorsal spine lies the descending aorta. The course of the esophagus is almost parallel to the spine below the arch of the aorta. The average distance between the spine and esophagus is about one inch. In its relation to the anterior and posterior thoracic wall the esophagus occupies a midway position, thus dividing the thorax into two equal parts. Since the heart is located in the anterior half of the thorax under normal conditions, any encroachment of the heart upon the posterior half of the thorax is indicated by backward displacement of the esophagus. Thus the esophagus serves as an important landmark in recognizing enlargement of the heart in the anteroposterior diameter. There are, however, exceptions which will be discussed in the following paragraph.

In the presence of thoracic deformities the mediastinal structures may be found displaced in various ways. The thoracic deformity which is responsible for the

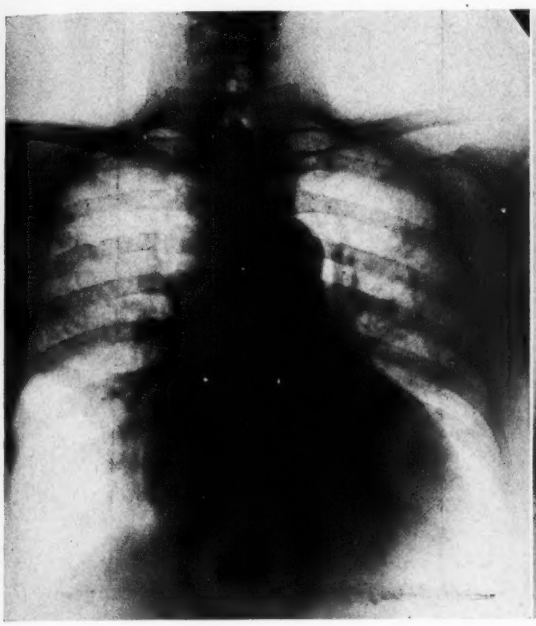

Fig. 6-*A*. The heart is greatly enlarged toward the left side, its configuration being that of aortic valve disease. The aorta is moderately dilated. The esophagus is displaced to the left below the arch. (Anterior view.)

Fig. 6-*B*. The esophagus is displaced backward through its entire course; the ascending aorta is dilated and is encroaching upon the anterior clear space; the descending aorta is overlapping the spine. (Lateral view.)

greatest displacement of the heart and esophagus is that of a funnel-shaped chest. In one case under our observation the heart and esophagus were found displaced to the right and backward; in another, to the left and backward (Figs. 2-*A* and 2-*B*). Scoliosis may affect the position of the heart and esophagus to a more or less degree, while kyphosis has very little influence upon their position, but the distance between the posterior border of the heart and spine is increased.

The position of the esophagus in pleuropulmonary affections is normal as long as the heart and aorta remain in normal position. Any condition of the lungs or pleuræ which affects the position of the mediastinal structures will invariably also affect the position of the esophagus. The displacement of the esophagus will be found to be in the same direction as the heart and aorta. Tumors of the posterior mediastinum, if not too large, will produce a local displacement of the esophagus without affecting the position of the heart. When a mediastinal tumor is of considerable size both the esophagus and heart will be found displaced. In the presence of pulmonary emphysema (Figs. 3-*A* and 3-*B*) no change is noted in the position of the esophagus, but the distance between the esophagus and dorsal spine is considerably widened.

The displacement of the esophagus in the presence of mitral valve disease takes place in two directions, to the right and backward. The displacement of the esophagus to the right is explained to be the result of rotation of the heart in a counter-clock-wise direction, in the presence of an enlargement of the right ventricle. The backward displacement of the esophagus is simply due to an enlargement of the left auricle or ventricle or both. The degree

Fig. 7-*A*. The heart shows left ventricular enlargement. The entire thoracic aorta is dilated and elongated; the esophagus is displaced to the left below the arch (not seen in the print). (Anterior view.)

Fig. 7-*B*. The descending aorta in its upper two-thirds is displaced backward, overlapping the spine. The walls of the descending aorta are parallel. The esophagus is displaced backward and follows the curve of the aorta. (Lateral view.)

of displacement of the esophagus to the right determines to what extent the left auricle is responsible in forming the right border of the heart in the anteroposterior roentgenogram. The backward displacement of the esophagus determines the extent of the enlargement of the left side of the heart. If the enlargement is confined to the left auricle alone, the displacement of the esophagus will be limited to the segment of the esophagus which is in direct contact with it (Figs. 4-*A* and 4-*B*). When the left ventricle is also enlarged, the esophagus is displaced backward through its entire course (Figs. 5-*A* and 5-*B*).

In aortic valve lesions the enlargement is at first confined to the left ventricle. The esophagus during this stage is very little affected in its position. As the lesion advances all the heart chambers increase in size. The esophagus is then displaced backward, but seldom to the same degree as in mitral valve disease. When the enlargement of the heart is associated with dilatation of the aorta, the esophagus is displaced backward and to the left (Figs. 6-*A* and 6-*B*).

In general enlargement of the heart without aortic dilatation, the esophagus is displaced backward and to the right (Figs. 5-*A* and 5-*B*). In general enlargement of the heart with aortic dilatation the esophagus is displaced to the left below the arch and backward. The descending aorta is as a rule also found displaced to the left and backward, overlapping the dorsal spine to a more or less degree (Figs. 7-*A* and 7-*B*).

In congenital heart disease, the position of the esophagus varies a great deal. It may be in normal position, although the anteroposterior diameter of the heart may be greatly increased. Under this condition the anterior chest wall is found to bulge forward, thus compensating for the increase in the size of the heart. More

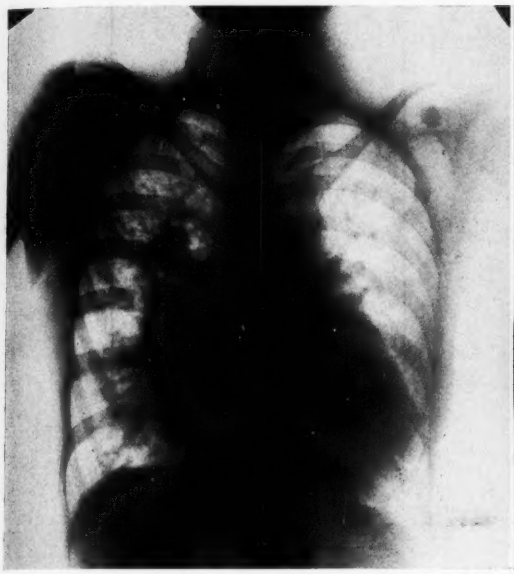

Fig. 8-*A*. Congenital heart disease in which the heart is enlarged; the esophagus is slightly displaced to the right; the hilar region is infiltrated with fibrous deposits. (Anterior view.)

Fig. 8-*B*. The esophagus is moderately displaced backward; the anterior chest wall is bulging forward; the anteroposterior diameter of the heart is enlarged. (Lateral view.)

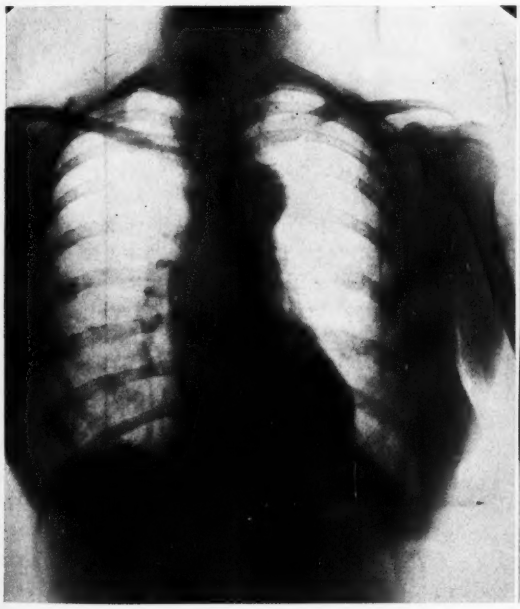

Fig. 9-*A*. The heart is of normal size; the aorta is dilated; the descending aorta is displaced to the left; the esophagus describes a semicircle around the arch of the aorta; below the arch the esophagus is displaced to the left. (Anterior view.)

Fig. 9-*B*. The ascending aorta is dilated and obscures the anterior clear space. The descending aorta and esophagus are moderately displaced backward. Behind the heart the esophagus is in normal position. (Lateral view.)

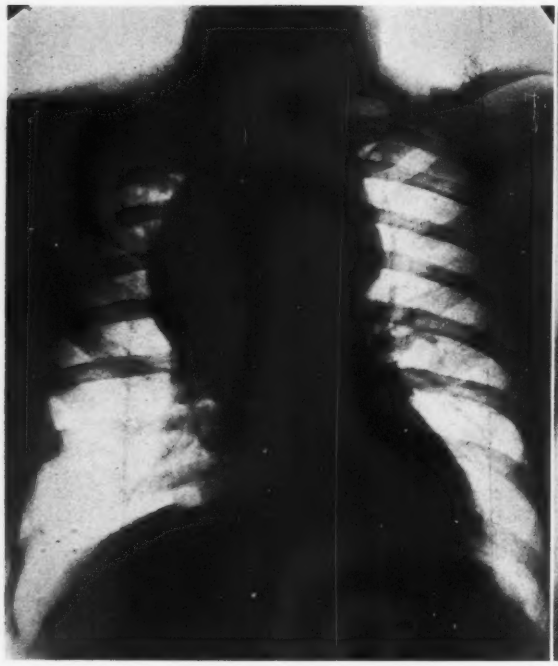

Fig. 10-*A*. Large saccular aneurysm arising from the arch of the aorta. The esophagus is displaced to the left. (Anterior view.)

Fig. 10-*B*. The aneurysm is located anteriorly, displacing the esophagus and descending aorta backward. Behind the heart the esophagus is not displaced. (Lateral view.)

often the esophagus is found to be displaced backward and somewhat to the right, but seldom to the same degree as in acquired lesions (Figs. 8-*A* and 8-*B*). In one of our cases, the esophagus was only slightly displaced backward, but the heart extended beyond the shadow of the esophagus, descending aorta, and spine. This finding was confirmed by a postmortem examination.

Moderate dilatation of the ascending aorta or arch does not affect the position of the esophagus, but when considerably dilated the esophagus is displaced backward in its upper half. When the arch is dilated the esophagus describes a semicircle, the size of which serves as an indicator to the size of the arch. When the descending aorta is also dilated the esophagus is displaced to the left below the arch and backward (Figs. 9-*A* and 9-*B*). In the presence of aneurysms, the direction of the displacement of the esophagus will depend upon the exact origin of the aneurysm. When an aneurysm arises from the ascending aorta or anterior portion of the arch, the esophagus is displaced backward (Figs. 10-*A* and 10-*B*): when it arises from the posterior portion of the arch the esophagus is displaced forward (Figs. 11-*A* and 11-*B*). When aneurysms arise from the descending aorta, the esophagus is displaced forward and either to the left or right (Figs. 12-*A* and 12-*B*). The visualized esophagus enables one to outline an aneurysm to a greater advantage than is otherwise possible. This is especially true in demonstrating fusiform aneurysms of the descending aorta (Figs. 11-*A* and 11-*B*).

Unless the heart is enlarged, no displacement of the esophagus takes place in simple pericarditis. In the presence of pericardial effusion, the esophagus is only slightly displaced backward, but the cardiac shadow extends beyond the border

Fig. 11-*A*. Heart is enlarged; aorta is dilated; the descending aorta is displaced to the left; the esophagus is displaced to the left below the arch. (Anterior view.)

Fig. 11-*B*. The ascending aorta is dilated and encroaches upon the anterior clear space. The descending aorta is overlapping the spine; its anterior border is displacing the esophagus forward. Note the fusiform appearance of the aneurysm. (Lateral view.)

of the esophagus which appears to be enveloped by the latter structure. This is to be expected in the case of a flexible body pressing upon another structure. Recently we had two cases of pericarditis with effusion, in both of which the cardiac shadow extended beyond the esophagus and overlapped the spine (Figs. 13-*A* and 13-*B*). After recovery, a re-examination of the heart with the visualized esophagus was done. The heart shadow was no longer found to extend beyond the esophagus, thus proving the nature of the cardiac enlargement. The failure to displace the esophagus in the presence of pericardial effusion will enable one to differentiate it from cardiac enlargement due to dilatation or hypertrophy or both, in which the esophagus is invariably displaced backward.

SUMMARY AND CONCLUSION

1. The esophagus occupies a midway position in relation to the anterior and posterior thoracic wall, dividing the chest into two equal parts. The heart, ascending aorta, and anterior half of the arch are located in the anterior half of the thorax; the posterior half of the arch, descending aorta, spine, and posterior thoracic sulci are located in the posterior half. Enlargement of the heart from any cause will encroach upon the posterior half of the thorax and thus displace the esophagus backward.

2. In pleuro-pulmonary diseases, if the displacement of the heart takes place the esophagus is usually displaced in the same direction. In pulmonary emphysema or kyphosis the distance between the esophagus and dorsal spine is increased.

3. In mitral valve lesions, the esophagus is displaced to the right and backward. The degree of displacement of the esophagus to the right will help to determine to what extent the left auricle contributes to the formation of the right border of the

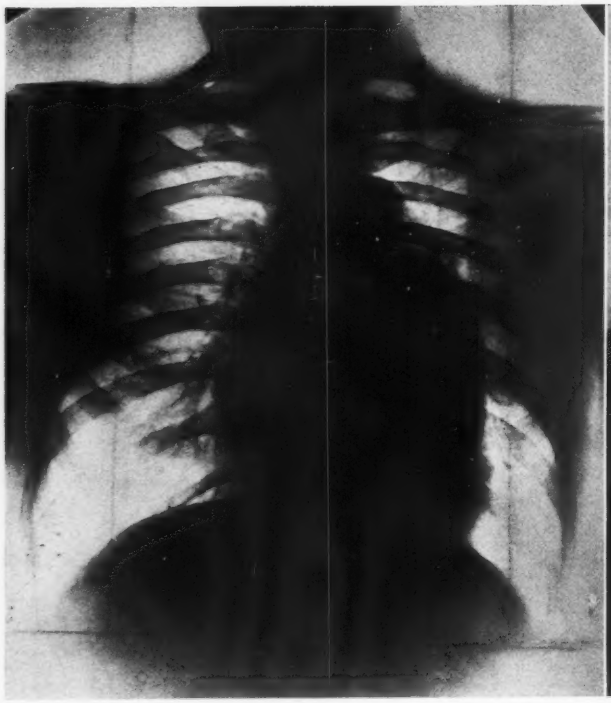

Fig. 12-*A*. The configuration of the heart shadow is somewhat peculiar; the esophagus is displaced to the right (not seen on the print). (Anterior view.)

Fig. 12-*B*. The esophagus is displaced forward by a saccular aneurysm located behind the heart. Note the erosion of the bodies of the dorsal vertebræ. (Lateral view.)

heart. The backward displacement of the esophagus determines the degree of enlargement of the heart in the anteroposterior diameter.

4. In aortic valve lesions, the esophagus is displaced to the left and backward. The degree of displacement of the esophagus to the left will help to determine the degree of displacement of the descending aorta to the left. The backward displacement of the esophagus determines the extent of the enlargement of the heart in the anteroposterior diameter and the degree of displacement of the descending aorta to the back.

5. In general enlargement of the heart without aortic dilatation, the esophagus is displaced to the right and backward: in general enlargement of the heart with aortic dilatation, the esophagus is displaced to the left and backward.

6. In congenital heart disease the displacement of the esophagus does not follow any definite rule—it all depends upon the particular defect or defects in the heart and blood vessels. The esophagus is frequently found to be displaced to the right and backward, but seldom to the same degree as in acquired lesions. Very frequently the anterior chest wall is found to protrude forward to compensate for the enlarged size of the heart in the anteroposterior diameter.

7. In the presence of dilatation of the aorta without cardiac enlargement, the esophagus is displaced to the left and backward only behind the great blood vessels. When the heart is also enlarged the esophagus is also displaced behind the heart. In the presence of aneurysms, the position of the esophagus will help to differentiate between aneurysms arising from the as-

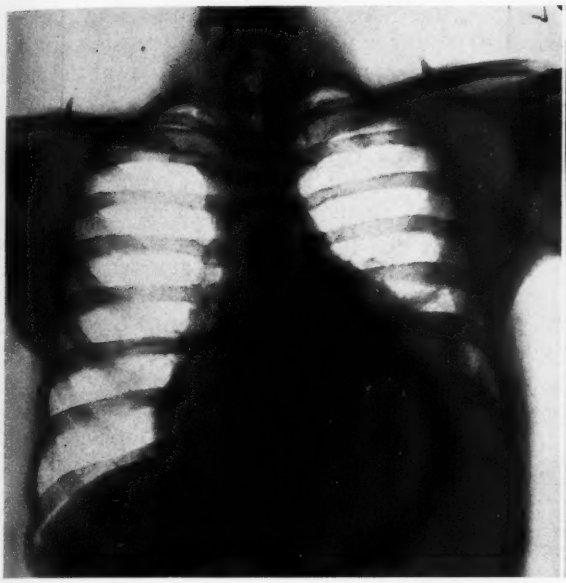

Fig. 13-*A*. The heart is greatly enlarged toward both sides; the esophagus is in normal position. (Anterior view.)

Fig. 13-*B*. The esophagus is slightly displaced backward behind the heart; the heart shadow extends beyond the shadow of the esophagus as if enveloping it. This was a case of pericarditis with effusion. (Lateral view.)

cending aorta and anterior half of the arch, and those arising from the posterior portion of the arch and descending aorta. Thus, backward displacement of the esophagus will indicate the origin of the aneurysm to be the anterior portion of the aorta, while forward displacement of the esophagus will indicate the origin of the aneurysm to be the posterior portion of the aorta.

8. In the differential diagnosis between enlargement of the heart and pericardial effusion the determination of the position of the esophagus will prove of great help. In enlargement of the heart as a result of dilatation or hypertrophy or both, the esophagus is invariably displaced backward and either to the left or right. In the presence of pericardial effusion the position of the esophagus is almost unchanged. In the lateral position, the heart shadow is seen to extend beyond the shadow of the esophagus and often also the bodies of the vertebræ.

REFERENCES

(1) KOVACS, F., and STOERK, O.: Ueber das Verhalten des Esophagus bei Herzvergrosserung. Wien. klin. Wchnschr., 1910, **23**, 1471–1476.

(2) GABERT, E.: Die Lagebeziehung des Esophagus zur dorsalen Herzflache und ihre Veranderung durch Erweiterung des linken Vorhofs im Röntgenbilde. Fortschr. a. d. Geb. d. Röntgenstrahlen, August, 1924, **32,** 410.

(3) ROSLER and WEISS: Ueber die Veranderung des Esophagus verlaufes durch den vergrosserten linken Vorhof. Fortschr. a. d. Geb. d. Röntgenstrahlen, 1925, **33,** 717–722.

(4) RIGLER, L. G.: The Visualized Esophagus in the Diagnosis of Diseases of the Heart and Aorta. Am. Jour. Roentgenol. and Rad. Ther., 1929, **21,** 563–571.

(5) IDEM: The Roentgenologic Differentiation of Lesions of the Right and Left Heart. RADIOLOGY, June, 1933, **20,** 463–471.

(6) PATERSON, R.: The Value of the Roentgenologic Study of the Esophagus and Bronchi in Cases of Heart Disease, Especially Mitral Disease. Am. Jour. Roentgenol. and Rad. Ther., April, 1930.

(7) BROWN, S.: Radiology of the Thorax. RADIOLOGY, December, 1929, **13,** 515–525.

(8) IDEM: Superior and Posterior Mediastinum. Am. Jour. Surg., December, 1930.

(9) IDEM: The Roentgenologic Study of the Thoracic Aorta. RADIOLOGY, May, 1933, **20,** 343–352.

DISCUSSION

DR. LEO G. RIGLER (Minneapolis): I am pleased to hear the excellent presentation by Dr. Brown of this study. It has always been a source of some astonishment to me that the method which he has described has not been more generally used by roentgenologists. Since I first presented our work on this subject in 1929, we have used it consistently in our hospital, and have found it of the greatest value in the diagnosis of diseases of the heart and aorta. The esophagus, filled with barium, gives us an excellent opportunity to delineate the right and anterior borders of the aorta, a matter which is very difficult to do under other circumstances; particularly, as Dr. Brown so beautifully shows, in aneurysms of the descending aorta, the procedure is of very great value. My own feeling has been that in aneurysms of the ascending aorta, before the aorta turns into the transverse portion of the arch, the esophagus is very little affected because of the anterior position of this part of the vessel.

I must take issue with Dr. Brown, however, upon the question of the value of the esophageal displacement in the differentiation of lesions of the right and left heart. While it is no doubt true that there may be a minor displacement of the esophagus in congenital defects of the heart, even though the lesion is confined to the right side, these displacements are very small in comparison to the general enlargement of the heart. I did not mean to say that there was never any displacement in the right-sided lesions, but the important point is that the displacement is so small in degree in comparison to the general size of the heart, as shown in the postero-anterior view. Obviously, it must be borne in mind in this differentiation that occasionally congenital defects affect the left side of the heart. Not only that, but occasionally acquired heart disease may be confined to the tricuspid or pulmonic valves. Under those circumstances, of course, this differential point does not hold good. Where the lesion is confined to the right side of the heart, whether it be due to a congenital defect or to chronic disease of the lesser pulmonary circulation, there is very little opportunity for displacement of the esophagus. The reverse is true in those lesions which affect the left side, particularly, of course, mitral valve disease. We have found it to be an important differentiating factor.

I should like to call attention also to what appears to be somewhat of a misconception on Dr. Brown's part, which I may be able to clarify. This concerns itself with the point made as to the possibility of distinguishing pericardial effusion from other lesions by the appearance of the shadow of the heart, apparently lying posterior to that of the esophagus in the lateral view. If we recall the appearance of the thorax in a transverse section taken at about the level of the ninth thoracic vertebra, it becomes obvious at once how such a thing could occur from any enlargement of the left heart. The left ventricle enlarges posteriorly, but it lies well to the left of the esophagus, which is exactly in the mid-line. For this reason a posterior enlargement of either ventricle may occur in which the entire dilatation will be completely to the left of the esophagus; in the lateral roentgenogram the enlarged chamber of the heart may thus appear to be posterior to the esophagus without displacing it whatever. It is apparent that no displacement will occur in cases in which the enlargement is well over to one side of the esophagus. It is true that occasionally left ventricular enlargement of marked degree will displace the esophagus. This occurs under such conditions as pull the esophagus over somewhat to the left and the massive enlargement of the left ventricle carries it toward the mid-line and therefore brings it in contact with the esophagus. Under other circumstances, a rather marked enlargement of the left ventricle may occur, causing it to extend far posterior into the shadow of the spine, in the lateral view, without affecting the esophagus whatever.

May I compliment Dr. Brown upon his beautiful presentation of this very interesting subject.

APPARATUS FOR SERIAL RADIOGRAPHY AND THE DEMONSTRATION OF THE MUCOSAL RELIEF IN GASTRO-INTESTINAL EXAMINATIONS[1]

By JOSEPH C. BELL, M.D., *Louisville, Kentucky*

AT THE present time there seems to be considerable controversy as to the best type of roentgen examination to use in gastro-intestinal work. Many American radiologists depend largely upon the fluoroscopic examination. Dr. Lewis Gregory Cole is the great proponent of serial radiography. The so-called mucosal relief examinations have undoubtedly been employed to some extent by many examiners for years; however, recently Berg, Akerlund and others have written extensively on this phase of the subject and have described various types of apparatus for this kind of examination. It is not the purpose of this paper to enter into a discussion of the place of each of the above-mentioned examinations in gastro-intestinal work, but it is my own opinion that all should play a part in most cases.

I believe that serial radiography and the so-called examination of the mucosal relief have not come into general use because of the lack of suitable apparatus that can be adapted to that now in use. I have developed such apparatus in my own work and I thought that it might be of interest to describe it. I make no claim for originality in the principles involved, for many, if not all, of them have been used in equipment which has been described in this country or abroad. I shall include only sufficient illustrations of the films that I am making in order to show some possible applications of equipment of this type.

APPARATUS FOR SERIAL RADIOGRAPHY

Figure 1 illustrates a serial tunnel and tube support in use in the Norton Memorial Infirmary, one of the hospitals with which I am connected. It was built by Mr. J. W. Fowler, the engineer in that institution, at a cost for materials not exceeding thirty-five dollars. As can be seen, the tunnel is mounted with bearings in the tilting table, the bearings resting in the channel irons that ordinarily support a Bucky diaphragm. This particular tunnel is not counterbalanced but can be used upright by raising it and locking it in any position desired. This is not very convenient but is less expensive than one which is counterbalanced. I use the latter type in my office, however, and it has proven most satisfactory.

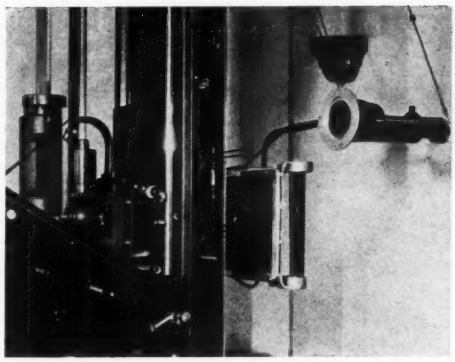

Fig. 1.

The tunnel in my office was made by removing the bakelite top from a so-called polygraph[2] and the metal back was cut out immediately beneath the opening in the lead diaphragm in order that fluoroscopic centering might be done. The polygraph was then mounted in the table with bearings similar to those used in the hospital, as above described. This polygraph has the advantage of having a track which permits films to be made in any position. In order to do so, however, it was necessary to place on the back of the polygraph a small metal angle iron which could be inserted through an opening into the track and thus hold the film carrier in place while the exposure in the left-hand corner of the film was being

[1] Presented before the Radiological Society of North America at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

[2] Sold by Picker X-ray Corporation.

made, with the patient upright. This angle iron is supported by a small rod and spring and can be pushed into the opening or withdrawn very readily. This tunnel has several advantages so far as ease of operation is concerned but, of course, is more expensive than the one used in the hospital.

I have a third tunnel, in Saints Mary and Elizabeth Hospital, where the tilting table has a Bucky diaphragm mounted in it. Because of this it was necessary to make an apparatus which could be removed when not in use. Mr. Fowler built this one also, using small thrust bearings which can be locked in place after the tunnel is inserted. I have experienced no difficulty in inserting the apparatus during the examination.

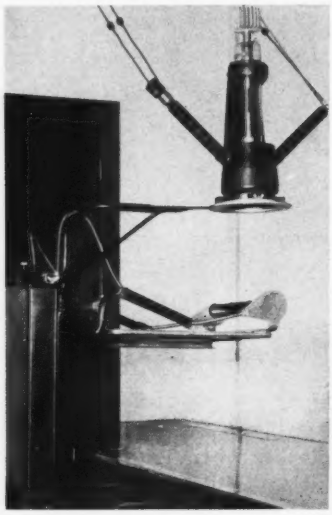

Fig. 2.

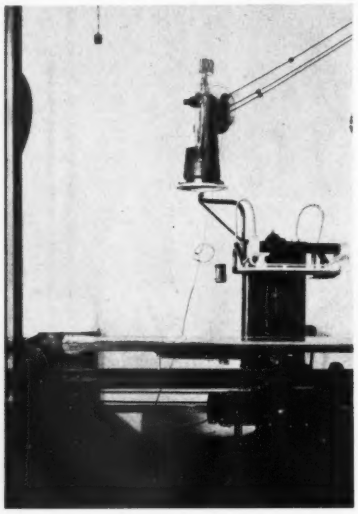

Fig. 3.

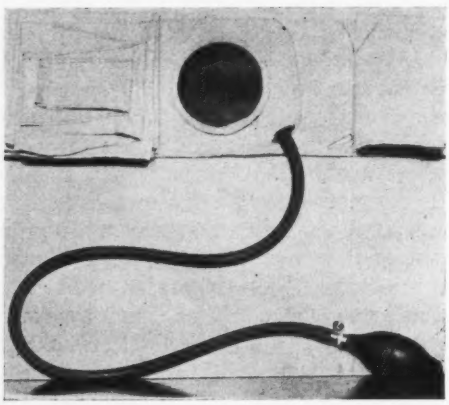

Fig. 4.

This certainly can be done with more ease than would be the case if the apparatus had to be placed directly beneath the patient on the top of the table. It permits serial examinations of very ill patients with the minimum amount of disturbance and effort upon their part.

The area to be examined is centered fluoroscopically and the films are then taken from the opposite direction with a second tube which is above the table. This, of course, reverses the fluoroscopic image, but I find that it does not interfere in any way with the demonstration of a lesion that has been found during the fluoroscopic examination.

The tube support is shown in detail in Figure 2. It was designed by me and built by Mr. Fowler. As will be seen, it rests above the fluoroscopic screen and interferes in no way with the usual fluoroscopic examination. When films are desired, after fluoroscopic centering, the tube is moved downward until it is directly over the part

under observation, and films are then made. In machines with a rail-mounted tube stand attached to the fluoroscope, this tube support is not essential. The radiographic tube may be energized through an overhead two-way switch connecting the generator either to the fluoroscopic or to the radiographic tube or by a separate machine. I use the latter means in my office and the former in the two hospitals with which I am connected.

Figure 3 shows the serial apparatus in the horizontal position.

Figure 4 illustrates a small compression band that was designed to use either with the patient upright or prone. When upright, the band is wrapped about the patient's body and compression made by inflating the small rubber bladder incorporated in it. As will be seen, the cloth envelope has been cut out on the side next to the patient and an ordinary automobile piston ring inserted into the opening and bound in this position. This is a great aid in localizing the pressure with the fluoroscope and also permits the compression bladder to pouch through the opening, resulting in more sharply localized pressure. This compression apparatus is now seldom used in the upright position because of other apparatus which I now have available and will describe further on in this communication.

Many individuals cannot be examined in the upright position and yet, in some of these cases, localized pressure may be of great value in demonstrating lesions. The bladder can be placed beneath the patient in the prone position, or, for that matter, in any other position. It can be so placed that it lies directly beneath the area to be compressed and then may be inflated until the desired pressure is obtained. Many ulcer craters have been demonstrated most satisfactorily in this manner, together with lesions in the large bowel as well.

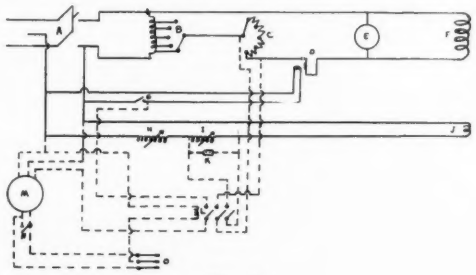

Fig. 5.

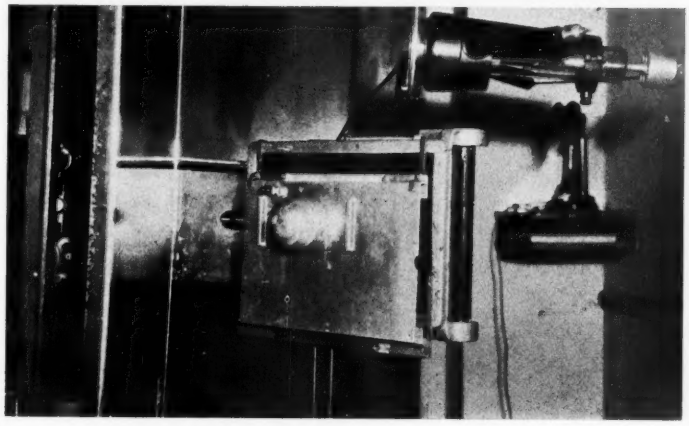

Fig. 6.

One's first impression might be that such an examination would be time-consuming, but I find exactly the opposite to be true. When I finish my fluoroscopic examination, except in special cases, I make eight serial

exposures on two 10 × 12 films, centering over any area where a lesion has been suspected. In the usual case, unless lesions are noted in other parts, I center over the distal half of the stomach and the duodenum, for the large majority of gastric and duodenal lesions will be found in this area.

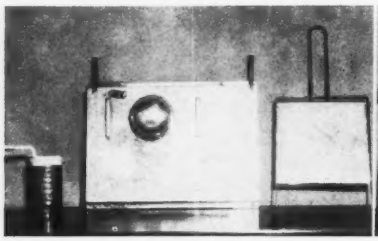

Fig. 7.

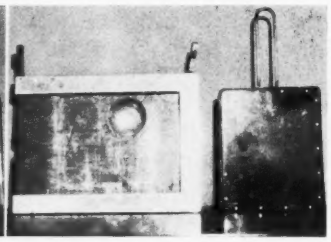

Fig. 8.

Films may then be made with the patient rotated into any position and at any angle from the upright to the Trendelenburg. Usually, however, they are made with the table horizontal and the patient in a semi-prone position, rotated to the right into such a position that the best possible visualization of the distal half of the stomach and duodenum will be obtained. I also make a single exposure of the entire stomach and duodenum in the direct prone position, generally using an 8 × 10 film.

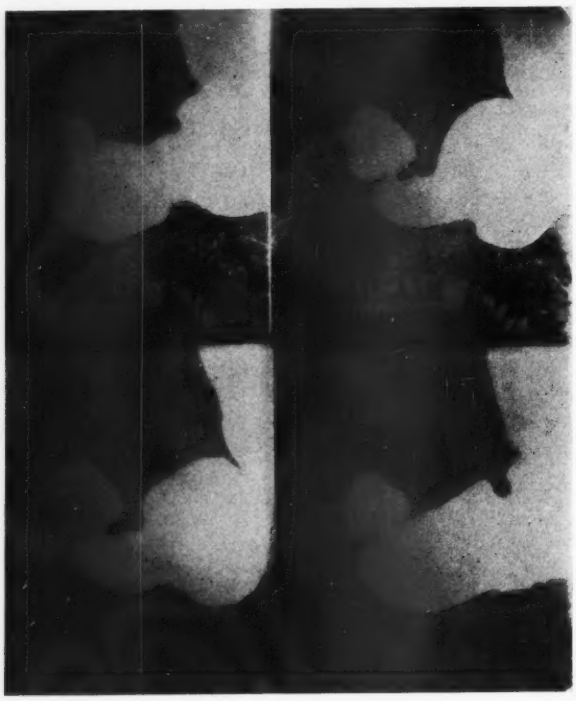

Fig. 9.

THE MUCOSAL RELIEF EXAMINATION

I have been interested for several years in the so-called mucosal relief type of examination, described by Berg, but until re-

cently have not had satisfactory apparatus for this examination. A short time ago I visited the Massachusetts General Hospital and had the privilege of observing the work that is being done in that institution by Dr. Richard Schatzki and Dr. George Holmes. I was more than ever convinced of the value of this examination when I saw their work and heard Dr. Schatzki discuss the subject at the Pittsburgh meeting of the American Roentgen Ray Society.

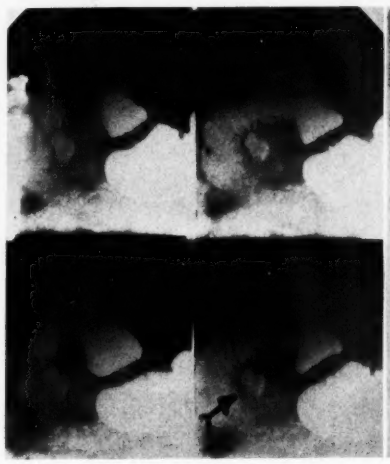

Fig. 10.

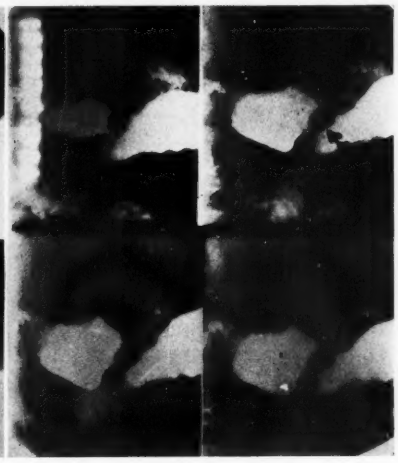

Fig. 11.

The apparatus that I am about to describe demonstrates beautifully the mucosal relief in most individuals, yet there are some in whom it cannot be used because of the position of the parts to be examined. It has no place in the examination of many acutely sick individuals, such as are frequently encountered in a general hospital practice.

When I became interested in the mucosal relief type of examination I experienced my greatest difficulty in switching over from the fluoroscopic to the radiographic setting after a lesion had been located with the fluoroscope. This was done by hand for a time, but was not satisfactory. Recently, Mr. Walter L. Abernathy[3] has built an apparatus for me which permits instantaneous switching from the fluoroscopic to the radiographic setting, and *vice versa*. The principles involved are undoubtedly well recognized, but, so far as we are concerned, they are original with us. I have always run my fluoroscope with considerable resistance in the primary circuit because, by so doing, tubes seemed to last much longer. It occurred to me that, with a suitable switch, this resistance might be short-circuited and thus prevent a drop in the voltage when the tube current was changed from that used for fluoroscopy to the radiographic setting. I planned to change the current by inserting resistance in the Coolidge circuit in such a way that this could be short-circuited at the same time as the rheostat. Mr. Abernathy suggested that we place a second Coolidge choke coil in series with the regular coil in the Coolidge circuit, for, he believed, this would be much more efficient than resistance. He also suggested that he wire my regular timer into the circuit in order that the exposure could be controlled accurately.

Figure 5 shows the wiring in the apparatus that we have made. The heavy black lines show in a simple diagrammatic manner the usual primary circuit of an x-ray machine, together with the Coolidge circuit and the circuit operating the remote

[3] Of the Dick X-ray Company, of Louisville, Ky.

control magnetic contactor. The broken lines represent the wiring and apparatus that have been added by us. *A* is the main control switch of the x-ray machine; *B* is the autotransformer; *C*, the rheostat; *D*, the remote control magnetic contactor; *E*, the kilovolt meter; *F*, the primary winding of the x-ray transformer; *G* is the exposure switch operating the 110-volt remote control magnetic contactor; *H* is the first filament choke coil (of the inductive type); *I* is the second coil (of a similar type), wired in series with the first coil; *J* represents the primary winding of the filament transformer; *K* is a single pole switch to short-circuit the second Coolidge choke coil at any time that one may desire to cut it out of the circuit (rarely used, however); *L* shows a triple pole magnetic contactor; *M* is the motor-driven timer (exposures ranging from 1/20 to 20 seconds); *N* is the timer exposure button, and *O* represents a three-contact switch. As will be seen, all of the wiring is in the low tension circuit. It may seem somewhat complicated, but in actual operation it is very simple.

Fig. 12.

Operation.—The choke coil (*H*) is adjusted so as to give the proper filament current for radiography. This can be done by cutting out the second Coolidge choke coil with the hand switch labeled *K*. The second Coolidge choke coil is then placed in the filament line with the hand switch and is so adjusted that the proper fluoroscopic current is obtained. When fluoroscoping, the magnetic contactor is in the open position indicated in the diagram. When the three-contact switch, labeled *O*, is closed half-way, the holding coil (*L*) is energized, closing the triple pole contactor, which automatically cuts out all resistance and short-circuits the second choke coil, thus raising the milliamperage to that used for radiography. The switch also connects the return wire from the motor-driven timer to the holding coil on the main x-ray trans-

former. When the three-contact switch, labeled *O*, is completely closed, the motor-driven timer is energized and any predetermined exposure may be made. As can readily be appreciated, all of these changes take place almost instantaneously, and I have worked with the apparatus sufficiently long to know that the results are satisfactory. The switch (*O*) may be operated either with the foot or with the hand: I have used both methods but prefer to have the switch attached to the handle that shifts the film into position.

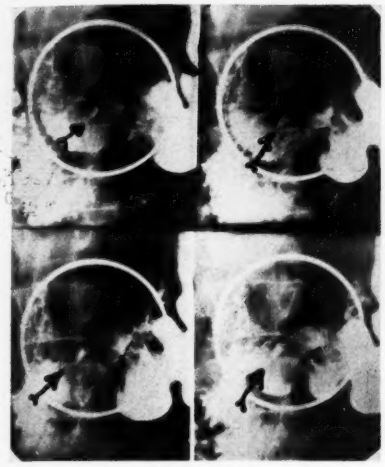

Fig. 13.

The cost of material for this apparatus is slight and the labor involved in making it certainly not excessive. It is not absolutely necessary to have the timer wired into this circuit, for the exposures can be controlled by the examiner without a timer. This may be of some advantage, for it permits variation in the exposure time with changes in the patient's position, without resetting the timer.

In order to do work of this type it is necessary to use a tube with sufficient capacity for the higher exposures. I have found that the Machlet CYR-C tube and the tube made by the General Electric Company, of a similar capacity, to be very satisfactory, and I believe that the Westinghouse Company is now building one which will also answer the requirements. The effective focal area of these tubes is approximately the same as the old 30-milliampere radiator type Coolidge tube and it was always considered a very satisfactory one for fluoroscopy.

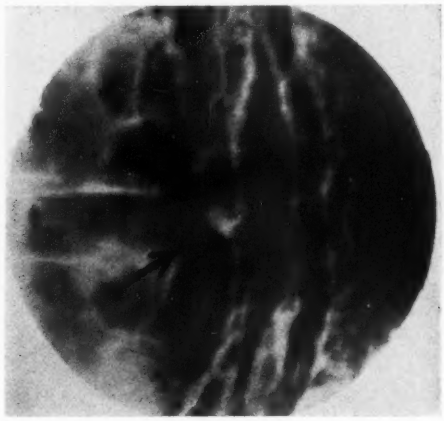

Fig. 14.

In my machine the amount of resistance in the rheostat is such that when it is short-circuited and the current changes from that suitable for fluoroscopy to that used in radiography there is practically no change in voltage due to the heavier load. In fluoroscoping a very heavy patient, I am likely to do so at approximately 80 peak kilovolts and a current of 4 milliamperes. When the change is made to radiography I will secure approximately the same kilovoltage with a current of 70 milliamperes. On smaller patients I usually employ a much lower penetration for fluoroscopy and a correspondingly low penetration when making films. This is regulated by the autotransformer setting, as would be done with an ordinary machine. The exposure time varies from two-twentieths of a second in small patients up to one-half second in very large ones. If it is desirable to have a greater spread between the kilovoltage used in fluoroscopy and in radiography, this is readily obtained by adding secondary resistance coils to the rheostat.

Figure 6 illustrates the film tunnel used

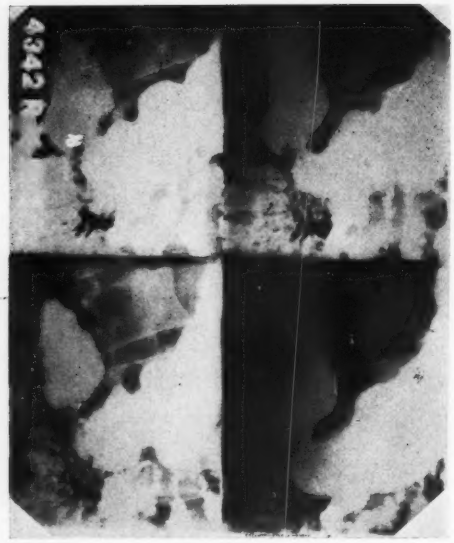

Fig. 15.

in my work when attached to the fluoroscopic screen, with the fluoroscope in the upright position. Figure 7 shows in detail the two parts of the serial tunnel, the tunnel itself, and the cassette carrier. The counterbalancing weight is also shown. It is so made that it can be suspended on the regular counterbalance of the fluoroscopic screen from a pin that is set in the counterbalance. Figure 8 shows the same parts of the apparatus except that the tunnel is viewed from the opposite direction. When not in use the counterbalance and tunnel are kept in a convenient place and at any time may be attached to the machine for use in an instant. After suspending the tunnel from the fluoroscopic screen an 8×10 cassette is inserted into the carrier shown and is moved to the left so that it rests behind the lead protection ready for use.

The patient is placed behind the upright fluoroscopic screen facing the examiner and is then directed to take one or two swallows of a heavy suspension of barium in water. The examiner makes pressure over the stomach or duodenum with the hemisphere of the apparatus by moving the fluoroscopic screen and apparatus toward the patient's abdomen with his left hand. The pressure brings the mucosal folds into sharp relief and all parts may be examined under careful fluoroscopic control. The fluoroscopic image is seen on the regular fluoroscopic screen in front of the opening in the lead shield of the serial apparatus. When a lesion is noted or a questionable area found, pressure is maintained with the left hand, the fluoroscopic switch is opened, the film is shifted into place with the right hand, and the patient told to stop breathing. The change from the fluoroscopic to the radiographic setting is made, together with the exposure, by pressing the small button of a switch incorporated into the handle of the carrier.

It is surprising how slight is the pressure necessary to bring the mucosal folds into sharp relief in most individuals, and how easily lesions may be demonstrated when they are seen during the fluoroscopic examination. It would be possible to make serial exposures without changing the pressure, but I usually readjust the pressure under fluoroscopic control after each exposure. I have seldom failed to demonstrate a lesion noted with the fluoroscope in most of the films, regardless of the change in the amount or direction of the pressure.

It is a matter of choice how many exposures should be made but usually four are sufficient. If one is examining the duodenum, exposures may be made in various positions, including a direct postero-anterior view, together with exposures in both right and left oblique projections. In the apparatus used by Dr. Schatzki the aluminum hemisphere can be removed and exposures made without any pressure, by placing the opening in the cylinder of the apparatus directly over the region to be examined. I have made use of this in my apparatus and it is of value in showing abnormalities in the contour of the duodenal bulb or defects in the margin of the gastric shadow.

I thought of making an automatic locking device which would maintain just the right amount of pressure after it has been secured, but have not done so because this

seems unnecessary with the type of apparatus that I employ. The design of such a device would be rather simple but it complicates the operation.

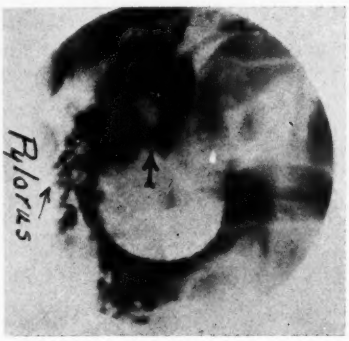

Fig. 16.

Fig. 17.

ILLUSTRATIONS OF SOME OF THE FILMS THAT CAN BE MADE WITH THE APPARATUS ABOVE DESCRIBED

Figure 9 shows serial films of the distal part of a normal stomach and duodenum. These films show the various phases of peristalsis and, in my opinion, are very valuable in determining the flexibility or lack of it in the gastric or duodenal walls. If, during the fluoroscopic examination, one waits until barium passes out of the stomach and fills the first portion of the duodenum, it is rare not to secure at least one satisfactorily filled first portion in the serial films and frequently this portion is well filled in all of them.

Figure 10 shows a diverticulum of the descending portion of the duodenum in serial films. Figure 11 shows the distal third of the stomach and the first portion of the duodenum in serial films. As will be noted, there is a constant niche-like irregularity just proximal to the pylorus, which was reported to be an organic lesion, whether benign or malignant could not be determined with absolute certainty. At operation this was found to be an ulcer and was considered to be benign. A second very small ulcer was found directly in the pyloric channel. This ulcer probably is shown by the irregularity to be seen in the pyloric channel in the film in the left upper corner of the illustration. The patient has been in relatively good health since the operation.

Figure 12 shows a deep penetrating ulcer of the lesser curvature near the junction of the proximal and middle third of the stomach, presumably benign in nature. Reexamination some two months later, after the patient had been under medical treatment with rest in bed, showed no evidence of an ulcer crater at this point.

Figure 13 shows four serial exposures, made with the patient prone, with localized pressure over the first portion of the duodenum. A definite ulcer crater can be seen in each of the exposures.

Figure 14 is a gastric mucosal relief film. This shows a relatively deep penetrating ulcer which was located in the posterior wall of the middle third of the stomach approximately 2 cm. to the right of the lesser curvature. This could not be shown in profile in any position in which the patient could be examined. I do not believe that it could have been demonstrated in ordinary films, but was shown very graphically in each of eight exposures made with the second serial apparatus above described.

Figure 15 shows serial films of the first portion of the duodenum in which no generalized deformity could be noted in either of the oblique positions or in the direct postero-anterior or anteroposterior views. In the serial films there is slight flattening of the posterior wall of the duodenum and in two of the films a slight irregular-

ity can be seen near the apex, but I do not believe that this is due to an ulcer crater. Figure 16 was made with the second apparatus described, in the same patient as Figure 15; a definite ulcer crater can be seen in the posterior wall of the first portion of the duodenum, indicated by the arrow. This ulcer was shown in each of eight exposures. Many of the exposures show swelling of the mucosa about the ulcer crater. At the time of the examination the patient was having severe symptoms in keeping with those found in an active duodenal ulcer.

Figure 17 shows the mucosal relief of the first portion of the duodenum, made with the second apparatus described. The first portion of the duodenum was greatly deformed, the changes being characteristic of those seen in an individual with an ulcer. There is marked scarring of the mucosa immediately beyond the pylorus in this film, but no ulcer crater can be seen. The pouch-like deformity on the lesser curvature side is, I believe, due to folding of the wall of the duodenum and not to a crater. The patient previously had symptoms of a duodenal ulcer but they were absent at the time of the examination and had been so for some time.

COMMENT

The illustrations presented are relatively few in number and form only a small part of the material that I have available. I am including them only to show some of the possible uses of the apparatus above described.

402 Heyburn Building

A RADIO FREQUENCY HIGH VOLTAGE APPARATUS FOR X-RAY THERAPY[1]

By ROBERT S. STONE, M.D., M. STANLEY LIVINGSTON, PH.D., DAVID H. SLOAN, M.S., *and* MILTON A. CHAFFEE, A.B., *San Francisco*

Division of Roentgenology of the Medical School and the Radiation Laboratory of the Department of Physics, University of California[2]

INTRODUCTION

DURING the development of the high voltage technic for nuclear disintegration purposes in the Radiation Laboratory of the University of California, under the direction of Professor Ernest O. Lawrence, one of the authors (D. H. S.) devised and constructed an apparatus for producing high voltages by the use of a radio frequency resonance transformer in vacuum. This method was announced in the "Physical Review"(1) and was amplified in another article, soon to appear. Tests showed that peak voltages of from 700 to 1,000 kilovolts could be obtained and, when a suitable filament was installed, x-rays with this range of peak energies were obtained. When it became evident that such an apparatus could be made sufficiently practical, arrangements were made to install one in the University of California Hospital, in San Francisco, for the treatment of patients. This particular installation is described in the present article.

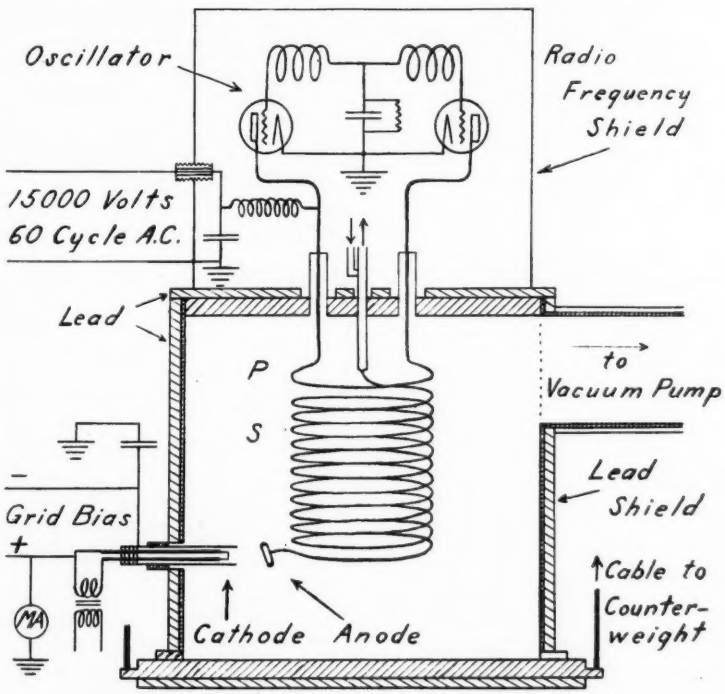

Fig. 1. Diagrammatic representation of the tube and circuit.

[1] Presented before the Radiological Society of North America at Memphis, Tenn., Dec. 3–7, 1934.

[2] We wish to acknowledge the generous support of Mr. William H. Crocker, of San Francisco, which has made this installation possible. The Christine Breon Fund for Medical Research has contributed some of the funds for the investigations. The original development of the method was largely supported by the Chemical Foundation and the Research Corporation. The advice and assistance of Prof. E. O. Lawrence, of the Dept. of Physics, and Prof. H. E. Ruggles, of the Division of Roentgenology, have been of inestimable value.

PART I—APPARATUS

Principle.—A very high power short wave radio oscillator sends its power into the high voltage resonant circuit instead of into the usual transmitting antenna. This high voltage resonance transformer is a helical spiral of about twelve turns of copper pipe, without insulation, supported by the upper end which is grounded to the roof of

Fig. 2. Photograph of the tube, showing the oil pumps.

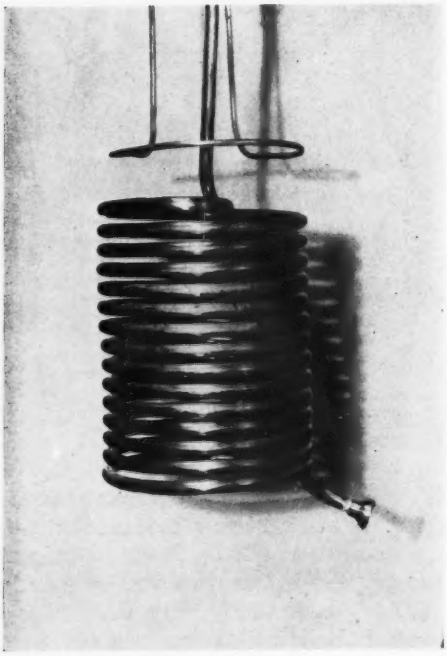

Fig. 3. Photograph of the primary and secondary coils outside of the tank.

the surrounding copper-walled vacuum tank. The coil, with its capacity to the walls, forms a quarter wave length resonant circuit with a voltage node at the top support and a voltage maximum at the bottom end which supports the x-ray target. The high voltage thus is produced entirely within the vacuum, exactly where it is to be used, and is free from all insulating material. Figure 1 shows the high voltage coil in the vacuum tank.

Description.—The vacuum tank which serves both as container for the transformer and as the x-ray tube, is cylindrical in shape, 42 inches in diameter and 40 inches high, with walls of three-eighths of an inch steel and end plates of 2-inch steel, the lower one of which is removable (Fig. 2). The tank is supported by having the top plate bolted to channel beams crossing the room with the ends securely mounted in the walls. A steel ring forms a ledge around the bottom of the tank and serves the double purpose of supporting the necessary lead for shielding and furnish-

ing a machined face for a rubber-gasket tongue-and-groove vacuum seal for the bottom plate. This is supported by counterweights and can be lowered, to give access to the interior. A large pipe for a pumping outlet and smaller ones for mounting the x-ray filament, primary coil insulators, main coil supports, windows, etc., are welded into the tank. Electric welding is used throughout.

The 10-inch pump manifold carries four brass Apiezon Oil pumps, 4 inches in diameter, with a total pumping speed of 300 liters per second, and has one 4-inch pump for the second stage and a Cenco Hypervac for rough vacuum. Suitable ionization

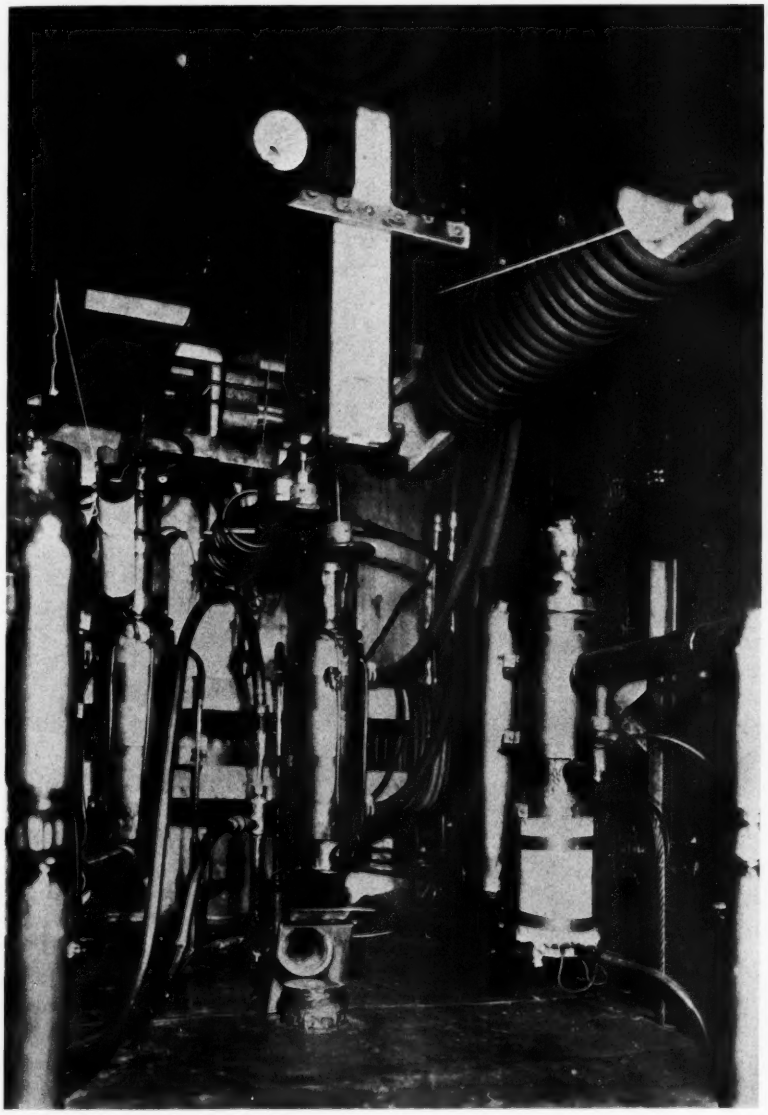

Fig. 4. Photograph of the essential parts of the oscillator tubes and circuit.

gauges and Pirani gauges are used to measure pressures, which are in the order of 10^{-5} mm. of mercury in the tank. Sealing wax is used for vacuum seals wherever ease of assembly is required.

A water-cooled copper lining is used inside the tank to provide low electrical resistance for radio frequency currents. For the high voltage secondary coil, seven-eighths of an inch copper pipe is wound into a spiral about 15 inches in diameter and of 12 to 15 turns, in such a manner that when supported from the top, the turns hang freely about three-eighths of an inch apart (Fig. 3). Inside of the main copper pipe is a smaller pipe covered with heat-insulating material to allow a circulation of water for cooling the coil and the target at the lower end, which is an internally cooled copper block with either a tungsten or a gold face. The upper end of the coil is supported by a clamp at the top of the tank so that the cooling water for the high voltage target enters and leaves at ground potential. Instead of connecting the oscillators directly, they are inductively coupled to the high voltage coil by a primary coil of one or two turns of tubing of the same diameter as the secondary coil. This primary coil is made of copper tubing three-eighths of an inch in diameter and is water-cooled. It is supported by leads which pass through pyrex glass insulators at the roof of the tank. The spacing between the primary coil and the secondary coil is adjustable. This controls the voltage "step-up" and is necessary for the exact tuning of the oscillating circuit to give the highest voltages.

The x-ray filament assembly differs from those in routine use. The filament itself is a straight tungsten wire in the vertical plane. This straight wire filament is recessed 2 mm. back from the open end of the surrounding grid. This shield, or grid, is connected in a separate circuit so that it can be maintained at a desired negative potential of several thousand volts. This negatively charged grid close to the source of the emission of electrons prevents their escape until the target reaches a very high positive potential. Thus, by proper adjustments, the x-ray output can be made to simulate that from constant potential direct current. This filament assembly is mounted through the side of the tank directly opposite the face of the target.

The two radio frequency power oscillator tubes were specially designed to give the required power at the operating frequency of 6,000 kilocycles, or 50 meters wave length. In each tube six 0.05-inch tungsten filaments 8 inches long are supported with individual spring tension to allow for expansion in such a manner that they are easily replaceable. Each grid is a helix of small copper wire wound on and soldered to six water-cooled copper tubes. Each anode is made of copper pipe 4 inches in diameter, with a brass water jacket, which allows a thin sheet of rapidly moving water to cool the anode. Each is pumped continuously by one 4-inch Apiezon Oil pump connected through insulating quartz tubing. The water for cooling the various circuits is circulated through rubber hose reels for voltage insulation. The grid is spaced from the filament and from the anode by glass cylinders which are sealed to the metal parts by wax joints and form part of the vacuum envelope of the tube.

The oscillators work into a "push-pull," "tuned-plate-tuned-grid" circuit, the ends of the primary coil being directly connected to the anodes of the two tubes. A separate grid coil is adjustable for tuning. Grid bias is supplied by a grid leak and condenser, while the anode is supplied by from 10,000 to 16,000 volts of 60 cycle alternating current power. Filters in the wires entering the copper box which completely surrounds the oscillating circuit, avoid the radiation of radio waves. This circuit is shown diagrammatically in Figure 1, and pictorially in Figure 4.

Protection of the operators and patients from the direct high voltage x-rays is accomplished by surrounding the walls of the tank with 1.5 inches of lead with an extra half-inch in thickness on the operator's side. This is installed on the tank by having sheets of lead one-quarter of an inch thick wrapped around the tank and supported by

the ledge mentioned previously. The 2-inch steel plates of the top and bottom of the tank are augmented by 1 inch of lead. Portals for x-ray treatments are cut through the lead and also through the walls of the tank, over which steel plates one-eighth of an inch thick are welded. To protect the operators from the relatively low voltage scattered radiation when the ports are open for treatment, the walls of the room are covered with lead one-eighth of an inch thick, and, in addition, the operators' control bench in the adjoining room is lined on sides and floor with lead one-fourth of an inch thick. Tests made with a suitable ionization chamber show the residual rays to be well within a safe limit for continuous operation for the voltages noted in this paper.

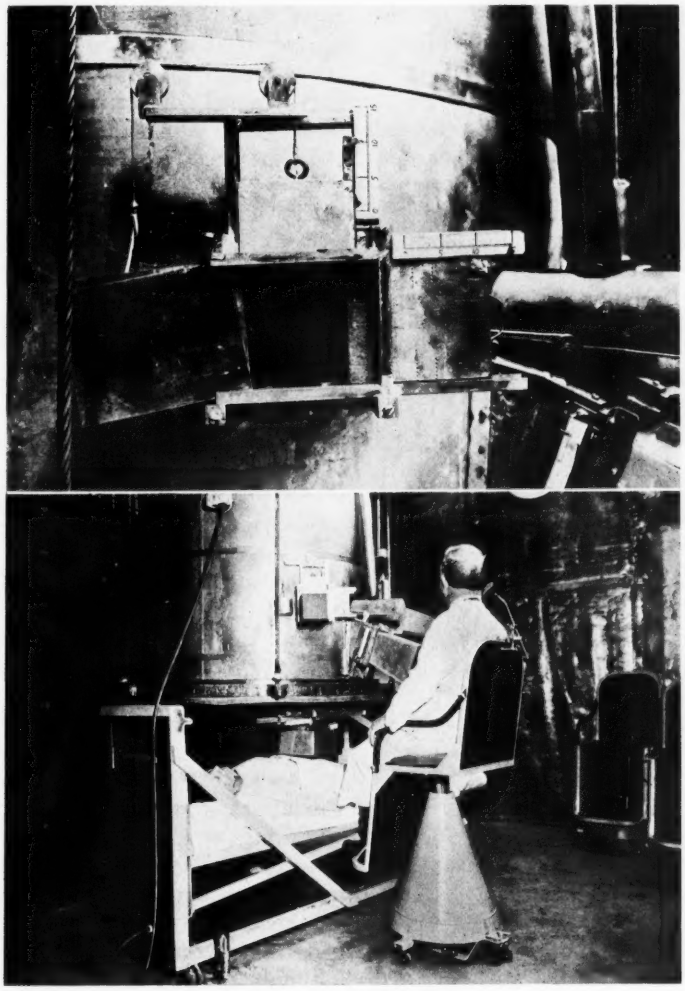

Fig. 5 (*upper*). Photograph of a port, showing the lead shutters to the right and above, and the filters partly removed on the left.

Fig. 6 (*lower*). Photograph of the tube from the opposite side to that shown in Figure 2, showing two patients set for treatments.

The four treatment ports are arranged

with sliding lead shutters one inch thick to give any desired rectangular or square aperture (Fig. 5). A slot for holding lead and copper filters is arranged on each port. Removable aluminum cones are provided to locate the treatment area on the patient. The ends of these cones are exactly 70 cm. from the target. One port giving a maximum treatment area of 22 by 22 cm. is directly below the target, two ports 15 by 15 cm. are placed on a horizontal level, and one port 18 by 18 cm. is directed downward 30 degrees from the horizontal. Two motor-driven cots and three motor-driven chairs are used to place the patients in position opposite the ports (Fig. 6).

Operation.—In operation, the apparatus is remarkably stable. High voltage discharges in the tank occur between metal surfaces and are harmless. They sometimes liberate sufficient gas from the metal walls to overload the oscillating circuit and force it to cease oscillating. This automatically stops the high voltage, and relays in the supply circuits, which are properly set for a small overload, open a circuit-breaker in the supply lines. A few seconds are usually ample for the pumps to evacuate this gas and the oscillations can be started again. Discharges of this nature occur normally in conditioning the apparatus for high voltages, but are rare when a stable operating condition is reached. In daily operation it is customary to have one or two such flashes during the five or ten minutes required to bring the apparatus up to the operating voltage at the start of the day. Neon glow lamps are attached to the oscillating circuit to indicate oscillations, and the glow flickers or disappears during such discharges.

The coil requires over 200 K.W. to generate 800 K.V., but by using 60 cycle power to supply the oscillator anodes, this maximum is attained only during a small fraction of the cycle. The average power consumed produces heat in the coil at the rate of only 30 K.W. when generating 800 K.V. On such a half-wave load as this, the power factor is low. A special design of transformer is used to supply the power. It has a 125 K.V.A. rating but only 75 K.W. is consumed while actually operating at 800 K.V. An additional 15 K.W. is continuously used throughout the operating day on auxiliary circuits.

The chief criticism of this type of apparatus has concerned its electrical inefficiency, and many have believed the power consumption to be formidable. It seems necessary to point out that, although the power consumption is somewhat greater than for other installations giving similar voltages, the cost of power is less than the salary of an operator or nurse and is a small part of the operating budget. Since the cost of power is such a minor item of operating expense, it has not been considered expedient at this time to provide the apparatus with one of three improvements, any one of which will reduce the cost of electric power per r unit to a value almost as small as the cost by conventional x-ray tubes. These schemes consist simply of enormously increasing the intensity of the radiation for a much shorter period of use, which decreases the power wasted by the radio equipment directly in proportion to the decreased time of operation. Should a situation arise in which the cost of power is a more appreciable fraction of the over-all operating expenses, one of these schemes may be applied easily.

General Remarks.—The apparatus is rugged to an extreme, with its welded steel vacuum tank serving both as an x-ray tube and a high voltage insulator for the transformer. Punctures such as occur in glass or porcelain x-ray tubes are impossible. High voltage discharges, which are certain to occur when increasing the voltage applied to any apparatus, are confined in a metal chamber where no damage can result. Whenever a discharge takes place, the inherent characteristics of the circuit are such that the voltage on the coil drops to nearly zero, and a circuit-breaker then opens the power supply lines. In other words, it automatically protects itself from continued discharge, and far from causing damage, the high voltage discharges merely clean the all-metal surfaces so that even greater

voltages may be applied. Because of the absence of any exposed high voltage conductors, the installation can be made in a room of ordinary size, instead of requiring a large building to surround it.

The replacement of parts which burn out, such as filaments and targets, is extremely simple and inexpensive and usually the apparatus can resume operation again the same day.

REFERENCE

(1) SLOAN, D. H.: Phys. Rev., 1933, **43,** 213; 1935, **47,** 62.

(End of Part I)

RENAL TUBERCULOSIS[1]

A PLEA FOR EARLY DIAGNOSIS

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ADVANCEMENT in the diagnosis of phthisis has steadily progressed since the classic description of its lesions by Ballie and Laënnec. Clinical medicine has improved its methods of examination, while pathology, bacteriology, and roentgenology have added brilliant chapters to the study of pulmonary tuberculosis. As a result the phthisical patient is recognized sooner and consumption is not now the hopeless disease it was a few years ago.

The advances in the diagnosis of renal tuberculosis have lagged behind those of phthisis. There are many reasons for it: the disease is more insidious, the symptoms are often minimized, and the physical signs are not appreciated by the doctor. The chief reason, however, is that all of us have been less concerned with an early diagnosis of renal tuberculosis than with that of phthisis.

The pathogenesis of phthisis is quite well understood. The contributions of Ghon (1), Ranke (2), Aschoff (3), Tendeloo (4) and others have given us a clear conception of the primary lesion, its progression, spread, and effect on modifying the course and anatomical changes of a reinfection. Notions regarding the pathogenesis of renal tuberculosis are not so clear. In the mass of conflicting literature there seems to be fairly definite agreement that a tuberculous lesion of the kidney is never primary—that it is always produced by organisms brought to the kidney from a lesion elsewhere. Certain embolic lesions of the renal cortex and miliary tuberculosis are brought about by a hematogenous dissemination. The manner in which the tubercle bacilli produce tuberculous pyelitis, papillitis, and diffuse caseous tuberculosis of the pyramids—renal phthisis—is still debatable. There are those, like Huebschmann (5), who say that the hematogenous route of dissemination is the only one deserving serious consideration. Tendeloo (4) advances some good arguments to support his view that these lesions begin about the renal papilla and are of lymphogenous origin. Aschoff (6) includes in a discussion on the subject a description of the mechanism of ascending infection, while Stoerck (7) points out that if ascending infection occurs, we ought to be able to demonstrate the progress of the lesions from below upward.

Two questions of importance bearing on the early diagnosis of renal tuberculosis are: (1) does a sound kidney excrete tubercle bacilli and (2) do renal lesions heal spontaneously? That a sound kidney does not excrete tubercle bacilli is well proven by the brilliant and careful researches of Dimtza and Schaffhauser (8), Medlar and Sasano (9), and Lieberthal and Huth (10). It follows that tubercle bacilli in the urine mean a tuberculous lesion in the urogenital tract. That some healing occurs has been demonstrated by Medlar (11). It is, however, not of such a degree as to exclude the need for surgery except in the miliary variety or in cases in which both kidneys are tuberculous.

The crucial question in the early diagnosis of renal tuberculosis, once a renal lesion has been demonstrated, is: is it tuberculosis and how extensive is the damage? Any answer worth while must be deduced by the combined methods of urology, the laboratory, and of roentgenology.

[1] Presented before the Radiological Society of North America at the Twentieth Annual Meeting, in Memphis, Tenn. Dec., 3–7, 1934.

The laboratory has three methods of approach to the problem: the stained smear from the urinary sediment, the cultural method, and the inoculation of animals with the suspected material. All three are valuable, and all three have limitations with which all concerned should be acquainted. The smear made from urinary sediment and stained for tubercle bacilli has the disadvantage that one demonstrates only acid fast bacilli. By itself, it can readily lead into error. The guinea pig method is of more value—it demonstrates, when positive, that tuberculosis is present. One gets some idea too, of the virulence of the organism. The method often fails because animals die of intercurrent infection or of one introduced with the tuberculous material.

The cultural method has the advantage that it is technically simple, cheap, and reliable. It does not, however, demonstrate the pathogenicity of the organism. Occasionally contamination with molds occurs in cultures. We believe that in every case of renal tuberculosis all of the methods should be employed. They serve to check each other and in that way error and delay in the establishment of diagnosis are obviated, or, at least, reduced to a minimum.

Nearly 75 per cent of the earliest renal lesions are in the cortex. Subcortical lesions remain closed lesions until extension into the pyramid occurs. However, when ulceration takes place tubercle bacilli are liberated in the urine and an "open lesion" results. Should the lesion be located at the tip of a renal papilla, its ulceration into a calyx may at once set free tubercle bacilli, pus, and blood. One may readily understand the difficulty in establishing an early diagnosis of renal tuberculosis in cases in which the unilateral or bilateral nature of the lesion is in question. Then too, according to recent views, a renal tuberculosis which was unilateral in the beginning may become bilateral at a later date.

In accord with the modern idea of the majority concerning the genesis of unilateral renal tuberculosis, bacilli reach both kidneys even though the process is progressive on one side and retrogressive on the other. In the latter case there may exist a special factor which inhibits the infecting organism from gaining a foothold. Just what the determining factor in the genesis of unilateral renal tuberculosis is, requires further clinical and pathologic research. It is maintained that some degree of mechanical obstruction to the outflow of urine may exist which renders it difficult or impossible to demonstrate clinically.

One may safely state that the instances of bilateral renal involvement will increase in direct proportion to the thoroughness and accuracy of diagnosis. It is to be remembered that one should not overlook the possibility of a bilateral infection and perhaps subject the patient to an unnecessary surgical procedure. The opposite condition may exist, in which a diagnosis of bilateral renal tuberculosis has been made by error. Such a diagnosis may lead to deprivation of surgery when the only therapeutic agent is nephrectomy.

All recent writers on renal tuberculosis mention the fact that co-existence of renal and genital tuberculosis can be demonstrated to a greater extent than heretofore. One may readily understand that if renal or genital tuberculosis is a local manifestation of a generalized infection and follow most frequently pulmonary tuberculosis, the possibility of distribution of the tubercle bacilli to any part of the urogenital tract is always present. The possibility of infection by interchange from the urinary tract to the genital tract is readily recognized. Many patients presenting themselves with renal tuberculosis are free from genital involvement. Early appearance of tuberculosis in the epididymis is usually the reason for the patient's appearance in a physician's office, whereas early renal tuberculosis may not be brought to his attention until definite bladder symptoms are noted. In a recent study of the surgical records of renal tuberculosis (67 nephrectomies, 1928 to 1933), genital

involvement was noted in 34 per cent of the cases some time before or after the nephrectomy. This incidence of renal and genital tuberculosis is possibly higher than numerous writers state.

It is important to have information at hand relative to the pulmonary condition of the patient. Our routine is to have a roentgen-ray of the chest in addition to the physical examination. Many patients do not know that they have pulmonary tuberculosis, or if they are cognizant of it, they say nothing about it because the urinary symptoms predominate in the picture. The necessity of a thorough history may seem irrelevant, but it is amazing to note the dearth of clinical data in surgical records. This alone may account for the divergence of opinion as to the frequency of renal tuberculosis.

Adult tuberculosis is usually a chronic disease and the most acute symptomatology is often present in the urinary tract. The very nature of the disease in the kidney, as well as the intermittent activity of the ureteral and bladder lesions, leads to periods of remission in the signs and symptoms. This may give a false sense of security and cause difficulty in establishing a diagnosis. Patients without a previous urinary history are sometimes examined, and renal destruction, with active tuberculous infection, may be found. Predominance of urinary symptoms and the degree of their severity depend largely upon the amount of infection of the bladder. The urologist will often state that when early surgical treatment is instituted the function of the bladder is less impaired.

In a study of a series of cases of urogenital tuberculosis, marked involvement of the bladder was reported: the question was raised since the majority of writers have mentioned the fact that bladder infection has been greatly reduced. This may be true. However, in our clinic we very frequently note the typical contracted, irritable, tuberculous bladder. The ulcerative golf-hole meatus is becoming more rare. In more than half of the bladders examined, there existed about one or the other ureteral meatus changes which led the cystoscopist to believe he was dealing with a case of renal tuberculosis.

We employ ureteral catheterization in every case of suspected renal tuberculosis. Specimens of urine are collected for direct examination, culture, and inoculation of guinea pigs. There is always a question of debate whether the apparently normal kidney should be catheterized when the other one is tuberculous. I believe that infecting a sound kidney in such a case depends to a great extent on the skill of the operator. It has been the practice in our clinic to refrain from catheterization of a kidney if we are dealing with a nonfunctioning tuberculous organ on one side when the opposite meatus is normal and the indigo carmine excretion on that side indicates good function. If both kidneys present a fair or good functional dye test, we do not hesitate to investigate them for evidence of bilateral involvement. Excretion urography is not sufficiently positive to make this distinction for us, as some urologists believe. The possibility of carrying tubercle bacilli to the opposite kidney through a reflux from the bladder is slight if cystoscopic and ureteral catheterization are properly done.

The use of indigo carmine intravenously as a functional dye test has not in our experience added much to the diagnosis. Braasch (12) has repeatedly emphasized the doubtful value of functional tests in renal tuberculosis. The recent observations of Lieberthal and Huth (10) in a series of cases of early renal tuberculosis indicate a diminution of renal function on the affected side in every case. Cryoscopy was employed as the method of choice for determining the function.

In employing urography in the diagnosis of renal tuberculosis, one should always follow the fundamental principle that it is unnecessary if a diagnosis can be made without it (Braasch, 12). In many instances in which the bladder and the ureteral orifices show no definite evidence of disease, nor suggestion of it, and the cul-

tures and smears give negative results, uretero-pyelography is the only means of identifying the lesion present. Pyelograms are indispensable in the diagnosis of early lesions.

Many urologists have the roentgenologist make simultaneous bilateral pyelograms. We do not do this at Jefferson, although every pyelogram made is done under fluoroscopic control. It is the exception rather than the rule to inject the renal pelvis by a syringe. We use the gravity method of allowing the sodium iodide solution to run into the renal pelvis, gauging the flow by the instruction of the roentgenologist. It is believed that this method tends to cause less irritation to the patient.

The early pyelographic filling defect found with renal tuberculosis is produced by a small area of renal destruction—a cortical abscess—usually found at the tip of a calyx. As the destruction becomes more marked, the filling defect is more noticeable and the typical feathery, fuzzy shadow of the calyx appears.

Excretion urography often fails to outline pelvic deformities. In early renal tuberculosis, the substances in use to-day do not delineate the minor deformities of calyx and pelvis. In cases in which there is some ureteral obstruction, as is often the case in tuberculous ureteritis, enough of the solution may remain in the kidney pelvis and bring out the pelvic deformity. It is only in advanced cases in which destruction and pylectasis are marked that the specific deformity is recognizable. In cases in which cystoscopy and ureteral catheterization are not possible, excretion urography is valuable, and may aid in establishing a diagnosis of renal tuberculosis. The interpretation of urograms should be made with great care and correlated in each instance with clinical findings. Retrograde pyelography still maintains its place as the more accurate method of roentgenologic diagnosis.

It is well to bear in mind that tuberculosis of the kidney may be co-existent with other renal lesions. Recently there was presented before a group of urologists a kidney showing an active tuberculosis with a carcinoma. Calculous disease may also be present; first, as a result of a calcification of the tuberculous process or as an independent lesion. A case referred to one of us revealed a calcareous density in the renal pelvis situated at the ureteropelvic junction. The clinical picture and symptoms were suggestive of urinary tuberculosis. A radiograph of the chest was reported by the roentgenologist as showing an acute respiratory infection. There was no evidence of lung tuberculosis. A retrograde pyelogram was suggestive of tuberculosis. The excretion urograms were misleading in view of our retrograde studies. Tubercle bacilli were recovered in culture and from an inoculated guinea pig.

The question of the diagnosis of renal tuberculosis resolves itself into a composite picture in which the internist, pathologist, roentgenologist, and urologist should hold sway. A closer contact with the internist, who sees many cases of general tuberculosis, cannot but impress the general medical profession that every patient with pulmonary tuberculosis is a candidate for renal tuberculosis. The necessity is evident, therefore, of instituting a complete urologic study in the presence of the earliest urinary symptoms.

Thus, the management of renal tuberculosis must be based upon the fact that it is an expression of a general infection. The best assurance of a permanent cure will result only if this thought is applied to our routine work.

BIBLIOGRAPHY

(1) GHON, ANTON: Der Primare Lungenherd bei du Tuberkulose der Kinder. Urban & Schwarzenberg, Berlin, 1912.

(2) RANKE, K. E.: Deutsches Arch. f. klin Med., 1916, p. 207; 1919, p. 224.

(3) ASCHOFF, LUDWIG: Lectures on Pathology. Paul B. Hoeber, New York, 1924, p. 34.

(4) TENDELOO, N. P.: Handbuch der Tuberkulose. J. A. Barth, Leipzig, 1914, pp. 1, 116, and 145.

(5) HUEBSCHMANN, P.: Pathologische Anatomie der Tuberkulose. Julius Springer, Berlin, 1928, p. 356.

(6) ASCHOFF, LUDWIG: Pathologische Anatomie. Gustav Fischer, Jena, 1923, p. 469.

(7) HENKE, F., and LUBARSCH, O.: Handbuch

der Spexiellen Pathologischen Anatomie und Histologie. Julius Springer, Berlin, **6,** 487.

(8) DIMTZA, A., and SCHAFFHAUSER, F.: Tuberkelbacillurie und initiale chronische Nierentuberkulose. Ztschr. f. urol. Chir., 1932, **35,** 440–484.

(9) MEDLAR, E. M., and SASANO, K. T.: Experimental Renal Tuberculosis, with Special Reference to Excretory Bacilluria. Am. Rev. Tuberc., December, 1924, **10,** 370.

(10) LIEBERTHAL, F., and HUTH, T.: Tuberculous Bacilluria and Excretion Tuberculosis. Surg., Gynec. and Obst., October, 1932, **55,** 440.

(11) MEDLAR, E. M.: Renal Infection in Pulmonary Tuberculosis. Evidence of Healed Tuberculous Lesions. Am. Jour. Path., September, 1926, **2,** 401.

(12) BRAASCH, WILLIAM F.: Practical Application of Excretory (Intravenous) Urography. Jour. Am. Med. Assn., Dec. 9, 1933, **101,** 1848–1852.

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A SPECTROGRAPHIC METHOD OF MEASURING VOLTAGE WAVE FORM OF A ROENTGEN TUBE[1]

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BECAUSE x-ray tubes are often run on alternating or pulsating current, the wave form both as to current and potential is important. Both affect the roentgen efficiency of the tube and the quality of the ray.

Dr. Chamberlain and I (1) studied this by a stroboscopic method, using hardness of the beam as a measure of momentary tube voltage: later, we worked with a cathode-ray oscillograph. I thought it might be interesting to try a spectrographic method.

If the first slit of an x-ray spectrograph is wide enough to take in the whole focal spot and the second slit consists of a wedge against the face of the crystal (Seemann slit) then the spectrograph will cover a considerable range of wave lengths with crystal stationary. Such a spectrum is of little value for studying the energy distribution in the spectrum because each portion originates in its own separate portion of the focal spot, and of course no focal spot is evenly bright all over. But such a spectrum is still useful for measurement of the short wave limit (2). It is true that photographic spectrography for short wave limit is not a very precise method at the higher voltages where $\lambda_{min.}$ is short and angles of reflection correspondingly small. But it is good enough for a rough evaluation. If such a spectrum is recorded through a radial slit onto a film rotating in synchronism with the voltage wave applied to the x-ray tube, then the minimum wave length will be recorded in polar coordinates for the whole cycle and one will have a record of the voltage wave form at the target.

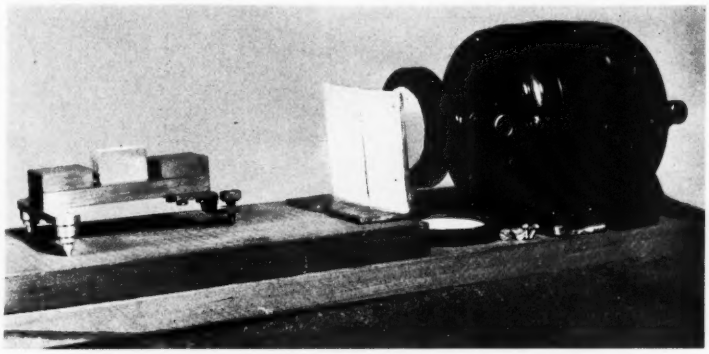

Fig. 1. Spectrograph, slit, and synchronously rotated double screen cassette for strobospectrography. These have been removed from their lead-lined box with the cover of the cassette off; the face of the lead plate has been whitened to show the slit.

The advantages of the method are its simplicity and the fact that the voltage measured is that of the electrodes within the x-ray tube and not some other place in the high tension circuit. Figures 1 and 2 are a photograph and a diagram of the roentgen strobospectrograph. Figure 3 exaggerates the vertical scale to make clear

[1] Read before the Fourth International Congress of Radiology, at Zürich, July 27, 1934.

what can be expected in the way of "resolution" from such a spectrograph. With a good calcite crystal the sharpness of the spectrum is very satisfactory. We have usually preferred rocksalt, however, because its lack of perfection increases its speed, sometimes to one hundred times that of calcite. It requires a very heavy exposure to bring out the short wave limit and then one begins to get halation, especially when using intensifying screens. This last pair of difficulties does much more to render the absolute values of voltage undependable than does the imperfection of the crystal. However, the relative values, *i.e.*, the general shape of the voltage wave, is more dependably shown.

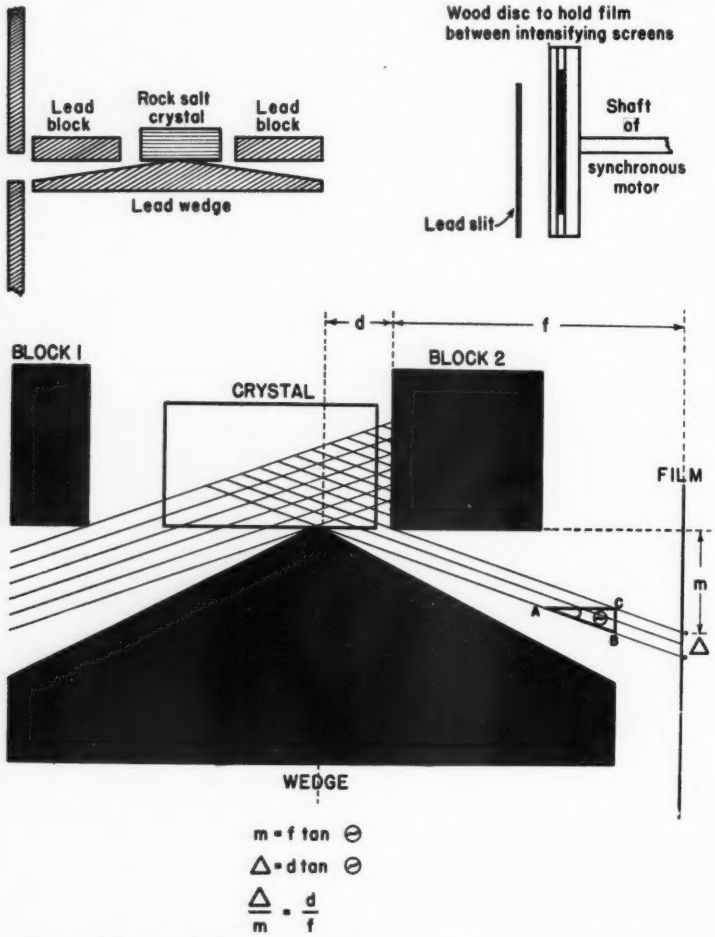

Fig. 2. Diagram of strobospectrograph.

Fig. 3. "Resolving power" of the spectrograph depends on the ratio of effective slit width to deflection. For any given wave length the deflection, *m*, is the film distance, *f*, multiplied by the tangent of the glancing angle of reflection. The small triangle ABC set in the reflected beam makes it easy to see that the effective slit width, Δ, is similarly equal to the actual horizontal slit width, *d*, multiplied by the tangent of the glancing angle of reflection. Therefore the resolving power depends only on the ratio of horizontal slit width to film distance and is constant throughout the range of wave lengths.

There is one pitfall that must be carefully avoided, namely, too small a focal spot to cover the entire voltage range.

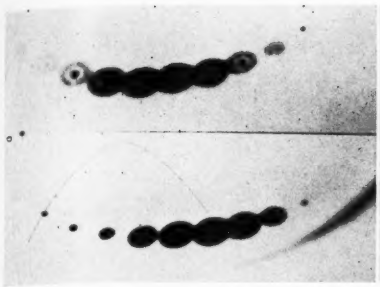

Fig. 4.

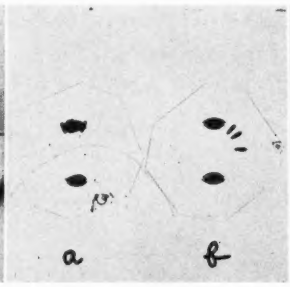

Fig. 5.

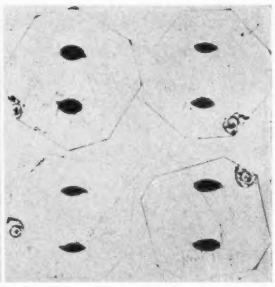

Fig. 6.

Fig. 4. Focal spots taken one-twenty-fourth cycle apart. This was a thick-walled, air-cooled tube, *i.e.*, the target cooled itself by radiation at white heat. Both records were made at 200 K.V. peak, 5 ma., the lower one when tube was first turned on, the upper one after 20 minutes' operation when the glass had become heated. The output when hot was 85 per cent of what it was when cold.

Fig. 5. Strobospectrograms from thick-walled tube: (*a*), tube cold; (*b*), tube hot. No change in setting between runs. Exposures 5 min., 200 K.V. peak, valve rectified, 5 milliamperes. The elongated black spots are spectra taken with the film standing still. They show the width of the radial lead slit. Their uneven spacing was used to record the direction of rotation of the film.

Fig. 6. Misleading strobospectrograms due to inadequate size of focal spot. These four records were all made at same settings but with differing levelings of the spectroscope before the tube.

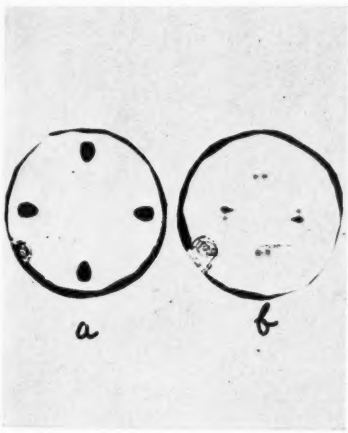

Fig. 7. Examples of strobospectrograms: (*a*) disc rectified at 130 K.V., short high tension leads; (*b*) four-arm (Snook) rectified at 100 K.V., long high tension leads. In the original film one can make out a triple voltage peak.

Fig. 8. Examples of strobospectrograms: (*c*) four-arm (Snook) rectified at 200 K.V.; (*d*) disc rectified at 200 K.V.; (*e*) valve rectified at 200 K.V.; (*f*) constant potential at 200 K.V.; (*g*) Sloan tube at about 700 K.V.

One may have to move the instrument relative to the tube during the exposure, so that a small focal spot may cover a wide range. One cannot depend on the focal spot's being the same size throughout the cycle. Figure 4 shows the variation of size of focal spot in a tube of thick glass, first cold and then after warming the glass by twenty minutes' operation with target incandescent. Figure 5 shows the misleading "tail" on the strobospectrogram during the times when the focal spot is very small. This disappears when the tube warms up. Figure 6 shows how the position of this tail changes for differing levelings of the spectrograph before the tube.

Some examples of strobospectrograms are shown in Figures 7 and 8—the captions explain them: only one needs further com-

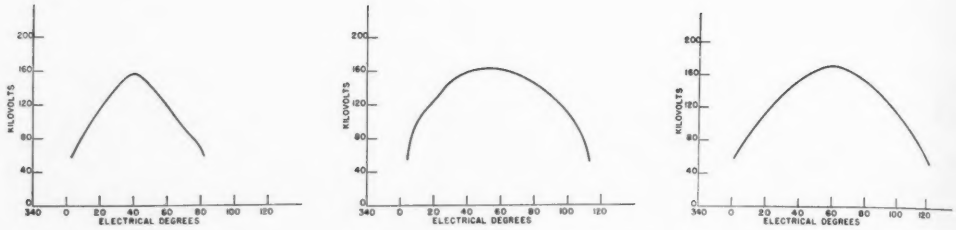

Fig. 9. Three strobospectrograms (*c*, *d*, and *e* of Fig. 8) reduced to voltage in rectangular co-ordinates. Obviously one's eye has stopped short of the short wave limit, for the curves go only to about 170 K.V., although sphere-gap readings in each instance gave 200 K.V. This 15 per cent error is presumably not to be taken at full value in interpreting the records for *wave form*, however.

Fig. 10. A cathode-ray oscillogram made at an earlier date on the same outfit giving strobospectrogram *e*. Note how much of interest in the lower voltages (below 50 K.V.) the strobospectrogram misses because of inadequate intensity.

ment, namely, the Sloan tube at University of California Hospital. This is a self-rectified Tesla Oscillator enclosed in the x-ray tube itself and operated at six megacycles. The individual waves, being only a six hundredth of a degree apart, are not seen separately. The wave actually seen, then, is the envelope of the six megacycle waves which are developed only during the peaks of the 60-cycle supply current. In all the others each sector element of the record is a constant potential sample of the alternating voltage wave.

SUMMARY

The author shows how a spectrograph with Seemann slit can be used with a synchronously rotating film to analyze the voltage wave form on a roentgen tube. He shows examples of such strobospectrograms.

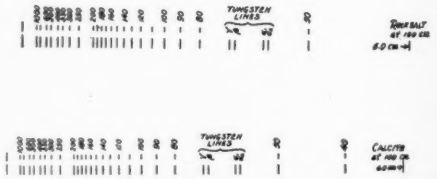

Fig. 11. Scales for measuring strobospectrograms made at 100 cm. (or at 20 cm. and enlarged × 5).

REFERENCES

(1) CHAMBERLAIN, W. E. and NEWELL, R. R.: Am. Jour. Roentgenol. and Rad. Ther., 1924, **12**, 509–513.

(2) LAURITSEN, C. C.: Phys. Rev., 1930, **36**, 1680–1684.

Dr. Lauritsen informs me he also built a spectrograph similar to the one I am using, but never published a description of it.

CERTAIN DIAGNOSTIC PHASES OF EXCRETION UROGRAPHY[1]

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SINCE Von Lichtenberg and Swick, in 1929, made intravenous urography a practical procedure, this method is proving of more and more value in the diagnosis of urinary tract pathology. At first it was thought that this procedure would be of use chiefly in those cases in which cystoscopy and retrograde urography were difficult or impossible. However, as time went on, the utilization of this method not only by the urologist but by the internist, etc., as well, proved of incalculable value in picking up both urinary tract and contiguous pathology, such as perinephritic abscess and retroperitoneal tumors. At the Michael Reese Hospital, in Chicago, where the work for this paper was carried out, the use of intravenous urography as a routine procedure is urged upon the internists, general surgeons, and gynecologists in any and all cases in which the diagnosis is in the least obscure. As a result, the amount of work on the genito-urinary service has more than doubled in the past four years, while the number of cystoscopies with retrograde urograms has decreased about 40 per cent.

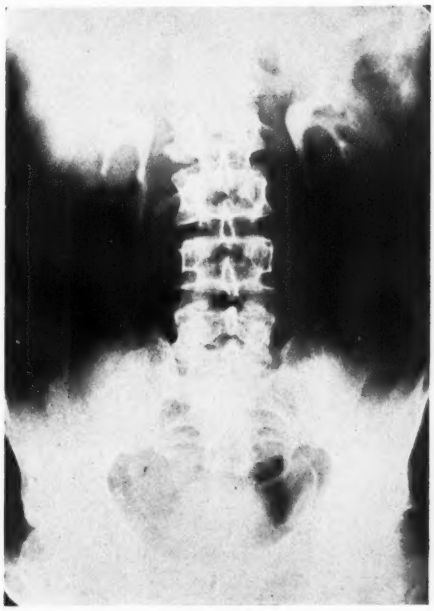


Fig. 1, Case 1.

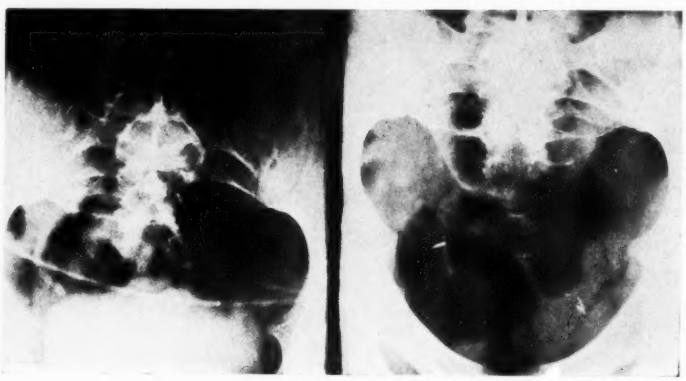


Fig. 2, Case 2.

Since our contribution is only part of a general symposium on Intravenous Urography, no attempt will be made to cover all of its phases, but we will confine ourselves to three main points, as follows: (1) The superiority of intravenous urography over retrograde urography in cer-

[1] Read before the Radiological Society of North America, at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

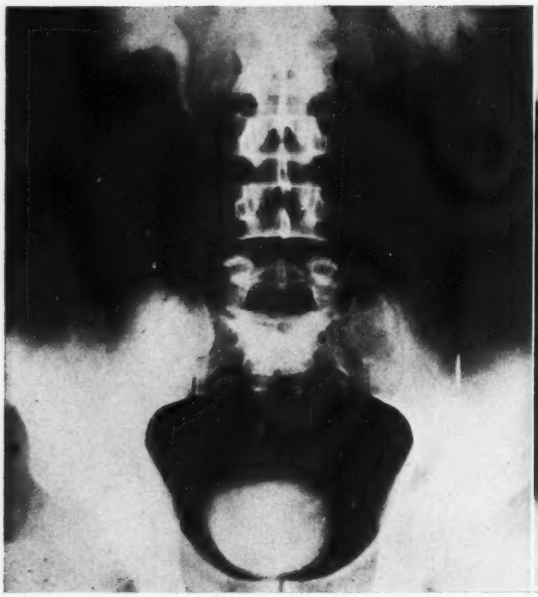


Fig. 3, Case 3.

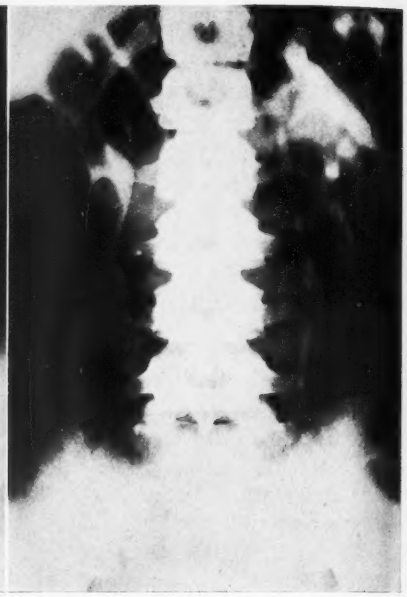


Fig. 4, Case 4.

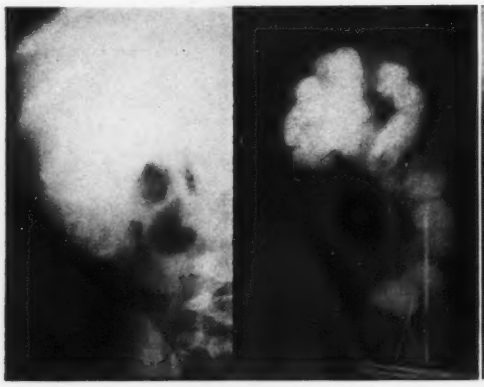


Fig. 5, Case 5.

Fig. 6, Case 6.

tain well-defined cases; (2) the use of intravenous urography in the differential diagnosis of intraperitoneal and retroperitoneal tumors, and (3) the value of intravenous urography in the diagnosis of ureteral stones, especially those of the radiotranslucent variety, accompanied by unilateral anuria.

1. THE SUPERIORITY OF INTRAVENOUS UROGRAPHY OVER RETROGRADE UROGRAPHY IN CERTAIN WELL-DEFINED CASES

Case 1. The first case is that of a normal intravenous urogram. There would be nothing unusual in this, were it not for the fact that this young man entered the hospital with all of the symptoms of acute appendicitis. In the routine study of the case, a moderate number of red cells were found in the microscopic urinalysis, some twenty to thirty to the high-powered field. A scout film of the urinary tract disclosed several questionable shadows, any one of which might possibly be a right ureteral calculus. Formerly, this patient would have been subjected to a cystoscopy and

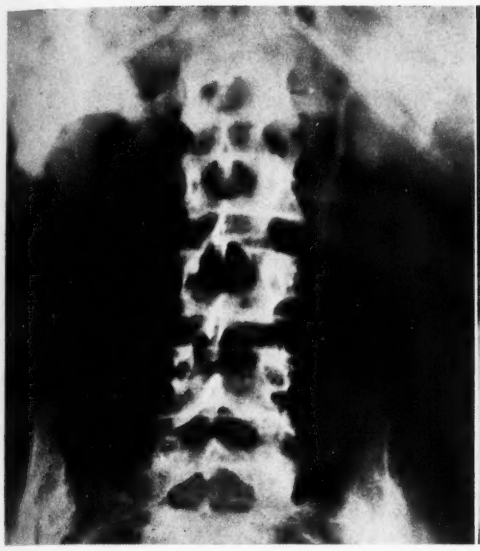


Fig. 7, Case 7.

Fig. 8, Case 8.

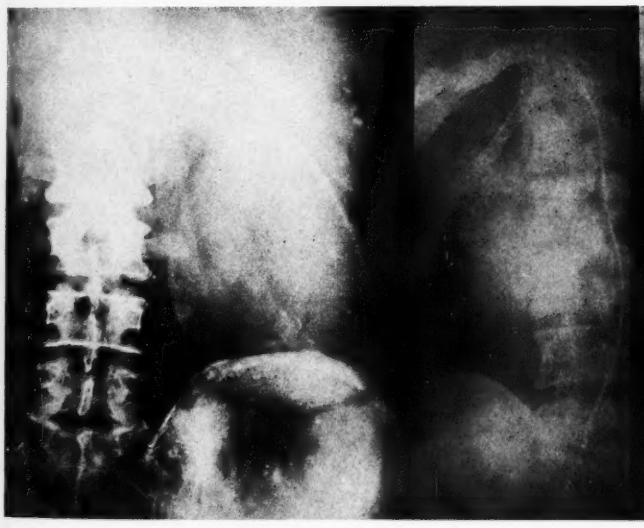


Fig. 9, Case 9.

Fig. 10, Case 10.

the passage of a shadowgraph catheter into the right ureter, with perhaps a right-sided pyelogram. However, a normal intravenous urogram ruled out the possibility of kidney or ureteral pathology, and at operation a retrocecal inflamed appendix was removed.

Case 2. A man of 25 entered the hospital with right lower quadrant pain, vomiting, temperature of 100° F., and leukocyte count of 12,000. He had exquisite tenderness along the course of the right ureter and the urine showed microscopic blood and pus. An intravenous urogram revealed a small but very definite shadow in the lower right ureter, with dilatation above the shadow. Narcotics were administered for the pain, and the

Fig. 11, Case 11.

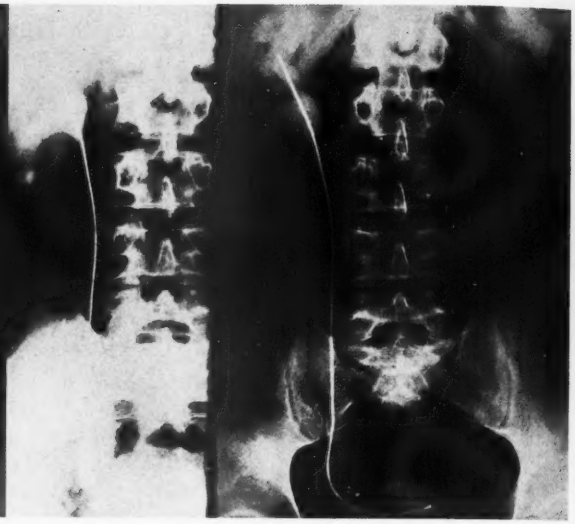


Fig. 12, Case 12.

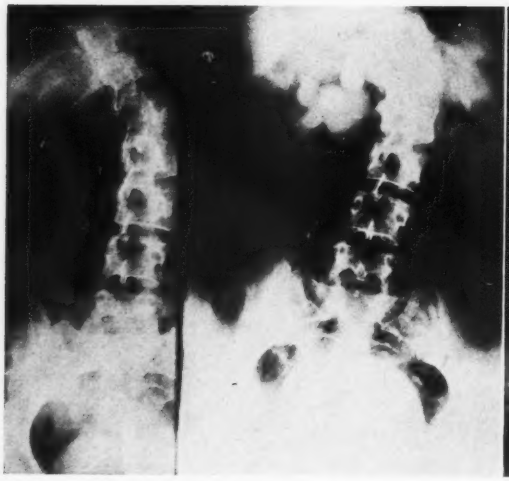


Fig. 13, Case 13.

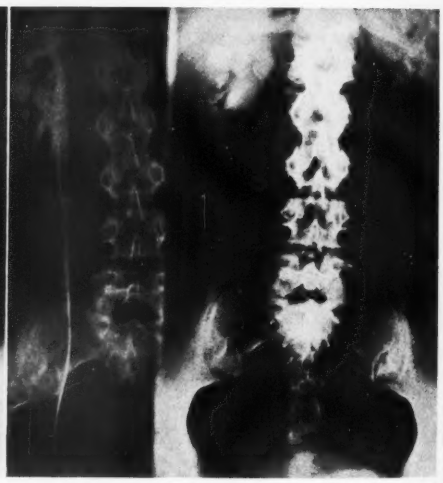


Fig. 14, Case 14.

next day the patient passed a stone, with complete cessation of his symptoms.

Case 3. The symptoms in this case were all left-sided, and a shadow on the scout film, coupled with the urinary findings of blood and pus, justified a diagnosis of left ureteral stone. However, an intravenous urogram verified this and obviated the necessity of cystoscopy and retrograde urography. As the shadow was of small size and located in the intramural part of the ureter, no manipulation was attempted. After the pain subsided, the patient was allowed to go home. He returned to the out-patient department five days later and produced the stone.

These three cases are more or less typical of many others in which the patients were saved the pain and discomfort, to say nothing of the danger of infection, reaction, etc., of a retrograde urogram. However, it would have been perfectly possible to

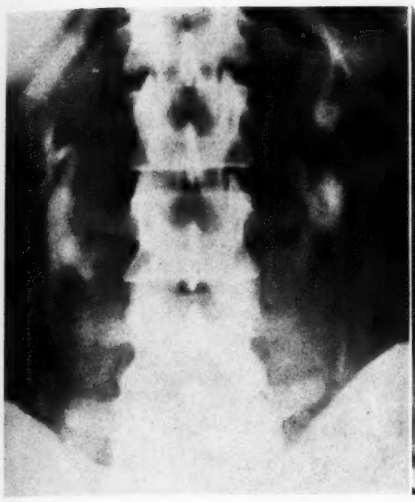


Fig. 15, Case 15.

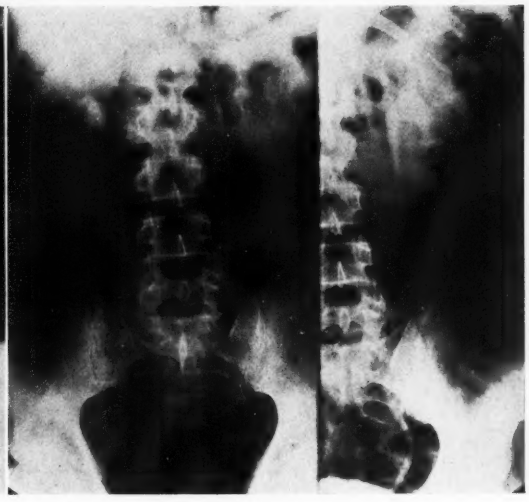


Fig. 16, Case 16.

carry out retrograde urography in the above cases, with perhaps equally good results as far as the diagnosis is concerned.

In the next three cases, in which an anomalous condition exists, namely, that of double ureter, the superiority of intravenous urography over the retrograde type cannot be questioned.

Case 4. A girl, 9 years of age, had had pain in the left upper quadrant of the abdomen and the back for the past six years. Her parents had consulted several leading pediatricians concerning the cause of this pain, but no definite diagnosis was ever arrived at. An intravenous urogram taken as a routine in just such obscure cases, disclosed an anomalous condition of the left upper urinary tract which could very well account for the pain.

Case 5. A male child six months of age had been treated for pyelitis for the past four months. However, when he began to have daily chills and fever, and the pus in the urine increased, he was taken to the hospital. An intravenous urogram using one-half the adult dose, as children tolerate this drug very well, disclosed an enormous destruction of the parenchyma of the right kidney, while the left side was perfectly normal. The right kidney, with a double ureter, was removed, and the child made an uneventful recovery, the wound (only four inches long) healing in six days. The value of intravenous urography in this case cannot be overestimated by those who appreciate the difficulty of cystoscoping and catheterizing the ureters of a six-months-old male infant.

Case 6. A man, 34 years old, had had pain, burning, and frequency of urination for the past six months. The venereal history was negative and there was no urethral discharge, but the urine contained both blood and pus in moderate amounts. In the early weeks of his ailment he had developed some discomfort in the left loin, and so he had consulted a urologist, who cystoscoped him and catheterized the ureters. He was told that he had a stricture of the left ureter, which should be treated by successive dilatations. Since the patient knew by experience that this was a painful procedure, he very naturally balked and asked for consultation, to ascertain if anything other than this could be done. An intravenous urogram disclosed a double ureter on the left side, the proximal end of one ureter ending in a blind sac. At operation, this ureter, ending in a blind sac, was resected, with complete cessation of all symptoms.

Case 7. One more case will serve fur-

ther to emphasize the first point which we wish to bring out, namely, in certain cases, the superiority of the intravenous route.

2. THE USE OF INTRAVENOUS UROGRAPHY IN THE DIFFERENTIAL DIAGNOSIS OF INTRAPERITONEAL AND RETROPERITONEAL TUMORS

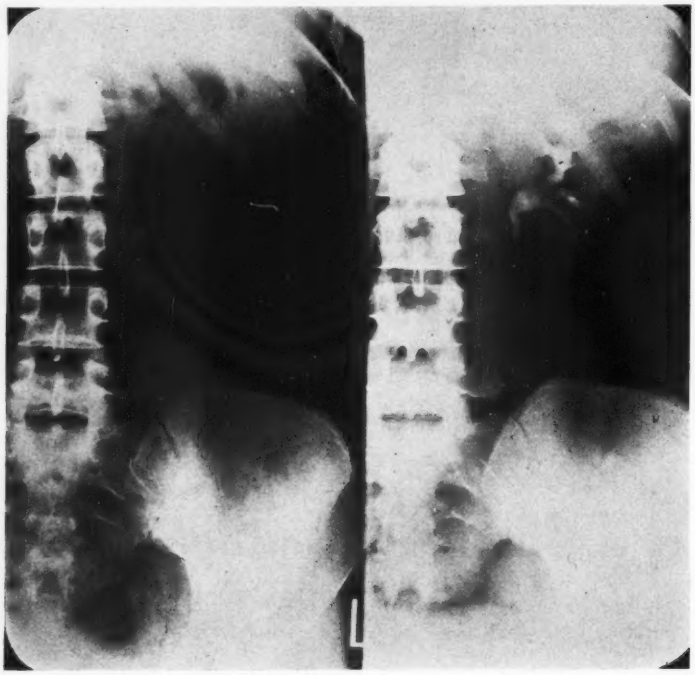


Fig. 17, Case 17.

A woman seven months pregnant entered the hospital with all the symptoms of impending uremia. The tongue was furred, the skin was dry, the urine scanty and concentrated, and vomiting and twitchings were in evidence. The blood chemistry disclosed a non-protein nitrogen of 216, with a creatinin of 8, while a scout film of the urinary tract showed a shadow apparently in the course of the right ureter. Realizing the difficulties and danger of the retrograde method in this case, an intravenous injection of dye was administered and the subsequent reontgenograms verified our suspicions of a right ureteral stone (Fig. 7). This stone was removed through a ureterotomy incision and the patient made a good recovery, went on to term, and was delivered of a normal infant.

Before the advent of intravenous urography, there were two known methods of differentiating intraperitoneal from retroperitoneal tumors, pre-operatively. One was by inflating the colon with air or contrast medium, to determine if the mass was in front of or behind the colon. This method was far from satisfactory, as there were several cases of tumor behind the colon and still intraperitoneal. The other method was by cystoscopy and retrograde ureteropyelogram. An intravenous urogram will accomplish the same result, as the following cases so clearly demonstrate. The retroperitoneal space is so small, normally, that it is practically impossible for a tumor of any appreciable size to exist in this locality without producing definite changes in the size, shape, or position of the ureter, pelvis, or kidneys. Therefore,

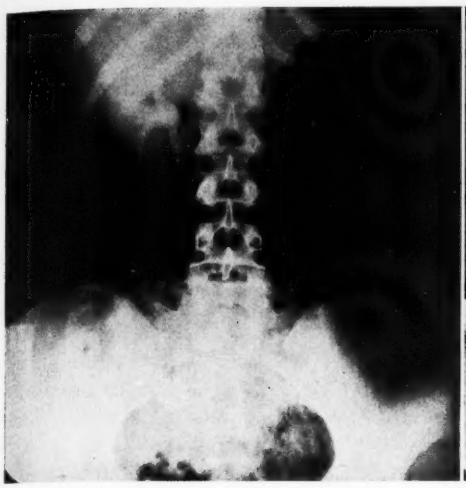


Fig. 18, Case 18.

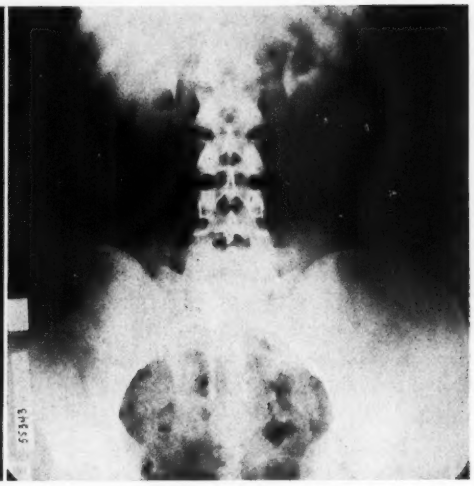


Fig. 19, Case 18.

a normal intravenous urogram is strong evidence against the presence of a retroperitoneal tumor.

Case 8. The patient was a woman, 32 years old and seven months pregnant, with a mass in the lower left quadrant of the abdomen, of the existence of which she was unaware until examination in the prenatal clinic. This mass was about the size of an orange, smooth, firm, not tender to the touch, and slightly movable. The vaginal examination of the left adnexa was unsatisfactory, due to the size of the gravid uterus. An intravenous urogram showed dilated ureters and pelves, but entirely within normal limits for a seven-months pregnancy. The right ureter was dilated more than the left, which is also a common finding in pregnancy after the fifth month. If the mass in the left side were retroperitoneal, it would be reasonable to expect to find the left ureter dilated more than the right. The patient was allowed to go on to term, and several weeks later a vaginal examination disclosed an intraligamentous cyst, which was removed by operation.

Case 9. A man, 75 years old, consulted his family physician because of obstinate constipation. During the course of the physical examination, the physician felt a mass in the left abdomen, and sent the man in on the general surgical service for a complete study. The urinalysis was normal and the gastro-intestinal examination was entirely negative. A scout film of the genito-urinary tract showed a circular shadow on the left side, but it was not very clear. However, the first film after the intravenous injection of contrast medium showed this mass in a much clearer light, and the subsequent films disclosed a marked increase in the pictorial density of this shadow. Since practically all of the medium is excreted by the kidneys, that mass must be either the kidney or a part of the kidney. There is no other way in which the contrast medium could get into the mass. On account of its globular appearance, etc., a diagnosis of a large cyst of the kidney was made. This diagnosis was confirmed at operation, when we were able to resect the cyst and save the kidney, which was otherwise perfectly normal.

Case 10. H. B., a male, 22 years of age, had an enormous mass which practically filled the entire right abdomen and extended even beyond the midline over to the left side. It was firm, but not hard in consistency, immovable, somewhat nodular, and not at all tender to touch. A shadowgraph catheter passed up on the

right side showed the ureter to be pulled over to the left beyond the midline, and a pyelogram disclosed a displaced and distorted pelvis on the right. An intravenous urogram not only confirmed these findings, but, in addition, showed a normal left upper urinary tract. This latter finding proved to be very valuable. At operation, an enormous lipoma, weighing 26 pounds, was removed from the right retroperitoneal space. The tumor was so intimately attached to the right kidney that it was impossible to dissect it free, and the kidney also had to be sacrificed.

Before discussing the final point in this presentation, namely, that of the use of intravenous urography in the diagnosis of ureteral stones, we wish to present a series of five cases demonstrating the superiority of intravenous urography over the retrograde type.

Case 11. Congenital solitary tuberculous kidney in a boy 18 years of age, in which case cystoscopy was impossible due to a contracted, inflamed bladder.

Case 12. Congenital solitary kidney in a man 42 years old, with a stone blocking the only ureter. A catheter was passed up beyond the stone, but intravenous urography disclosed the absence of the left kidney. The stone was subsequently passed.

Case 13. A right tuberculous pyonephrosis, shown very clearly by intravenous urogram, in which it was impossible to get up either catheter or contrast fluid by cystoscopy.

Case 14. A right tuberculous kidney in which the findings on retrograde urography were confirmed by intravenous urography, and, in addition, the opposite side was shown to be normal.

Case 15. A horse-shoe kidney, picked up by employment of intravenous urography as a routine procedure, in a case in which the diagnosis of the abdominal ailment was obscure.

3. THE VALUE OF INTRAVENOUS UROGRAPHY IN THE DIAGNOSIS OF URETERAL STONES, ESPECIALLY THOSE OF THE RADIOLUCENT VARIETY, ACCOMPANIED BY UNILATERAL ANURIA

Our last series of cases concerns the diagnosis of ureteral stones by the employment of intravenous urography. In cases in which there is a complete block of the ureter, the affected side invariably fails to secrete the contrast medium, and this in itself is a tremendous help in the diagnosis of ureteral stones, especially those of the radiolucent variety. As soon as the stone is passed, the kidney immediately begins to secrete. This was very beautifully demonstrated in the first case in this group, of which a résumé follows.

Case 16. Unilateral calculus anuria. Stone passed into bladder while the patient was on the x-ray table. The fifteen-minute film shows the kidney pelvis and the calices to be completely filled out.

Case 17. Stone blocking left ureter and producing unilateral anuria. Normal excretion after stone was removed by ureterotomy.

Case 18. Lack of excretion on the left side, in a young girl who had symptoms of backache and slight hematuria. No stone shadow visible. Bringing into use our previous experience in these cases, we cautioned against operation and advised delay. In two weeks' time a small stone was passed and subsequent films showed a normal left intravenous urogram.

SUMMARY

Intravenous urography should not be used by the urologist only, but should be employed as a routine measure in all cases in which the diagnosis is obscure.

In at least 50 per cent of the cases, cystoscopy and retrograde urography can be avoided.

It is by far the best method in differentiating intraperitoneal and retroperitoneal tumors.

Its value in the diagnosis of ureteral stones, especially those of the radiolucent variety, cannot be questioned.

MULTIPLE UROGRAMS: AN AID IN UROLOGICAL DIAGNOSIS

By EDGAR C. BAKER, M.D., *and* JOHN S. LEWIS, JR., M.D., *Youngstown, Ohio*

WITH the growth of work in urographic diagnosis many short comings in our methods have become increasingly noticeable. Our roentgen and other medical journals contain innumerable articles which deal with pathologic function in the other tracts of the body, notably the gastro-intestinal tract. From the roentgenologic aspect, there is a marked paucity of work dealing with pathologic function of the urinary tract. The work published along this line is largely of an experimental nature and carries little significance to those of us doing routine work in a situation in which experimental work is almost out of the question. It has seemed to the writers that, in urology, we, as roentgenologists, were content to drift easily along the lines of least resistance. In other fields we have dared to create, and actually have created, an ever-growing field of usefulness. A great amount of our information in medicine has come through our study and interpretation of the pathologic function. In this field roentgenologic methods offer a pre-eminent advantage. True, we have accepted the intravenous dyes and the wonderful advances made possible by the endoscopic methods of our urologic colleagues. In return, most of the time we have offered them very little but technical aids, which have changed but little, and these only as newer roentgen methods have compelled advance.

In 1922, Nichols (1) wrote that urographic diagnosis must be team-work, a statement which is even more true to-day. It is only when roentgenologists realize that they owe a real part to team effort, and act accordingly, that we will make greater advances. Where such team-work is in force, the urologist realizes the benefit to the patient and he abandons single-handed effort. The method of urographic diagnosis which will be described is based on adequate co-operation. The result is dependent on the closeness of mutual effort by urologist and roentgenologist.

While we realize the results we attain are far from the experimental efforts of Jarre and Cumming (2, 3, and 4), we also believe our results justify the technic employed. In addition, the method can be carried out routinely in any average roentgen department. From a diagnostic viewpoint, the method has added an increasing number of conditions recognizable roentgenologically and has been a distinct help in the finding of changes which occur in common urographic conditions. We have a sincere admiration for the well-known work of Jarre and Cumming. Unfortunately the expense of their method precludes its use for almost all of us. Methods can and will be devised which approximate their results for routine clinical purposes.

The method of Moore (5 and 6) brings the use of serial roentgenographic films into the realm of practical urology. This procedure can be adapted for routine work in most roentgen departments. This serial film, combined with pyeloscopy, we use for selected cases.

The history of the development of urographic diagnosis belongs more properly to a purely urologic paper. Opaque bougies were first employed. With the advent of the intravenous dyes an almost ideal medium came into use. On the roentgen side a few high lights should be mentioned. In 1918, after six years' experience, Manges (7) advocated the use of pyeloscopy. The continued development of the Bucky diaphragm has aided greatly. With increasing power and better tubes, speed in exposure time without the sacrifice of detail has become increasingly possible.

TECHNIC EMPLOYED

While we do not claim to present anything radically new, we do expect to pre-

sent a co-operative effort utilizing known procedures in a little-appreciated sequence.

Usually an ordinary film of the entire urinary tract is taken prior to cystoscopy. The usual cystoscopic examination is made. Inspection of the bladder—the posterior urethra in the male and the entire urethra in the female—is completed. Indigo carmine is injected intravenously and the time of appearance of a concentrated dye is noted. Catheters are passed into the kidney pelves, non-obstructing catheters being used whenever possible. Specimens are collected under aseptic precautions for laboratory examination. The cystoscope is removed and the catheters left in place, after which second specimens for laboratory examination are collected. The patient is now transferred to a roentgenologic table with the usual fluoroscopic and Bucky equipment.

If a film has not been taken prior to cystoscopy, this is now done. In cases showing a suspicious shadow or shadows in the region of the ureter a shift exposure is made. The catheters are now connected by means of metal adapters to syringes containing a known amount of 15 or 20 per cent skiodan. *Under direct fluoroscopic control the pelves and calices are filled by gravity.* When satisfactory visualization is complete the catheters are drawn down to a point about eight centimeters from the ureteral meati. The roentgenographic set-up is then thrown in quickly, the catheters are withdrawn, and the lower ureters slowly injected with one cubic centimeter of the opaque medium. The first film is taken as the catheters reach the bladder at the signal of the urologist. Two or three other films are then made as rapidly as possible. Exposure time varies from one-half to three-fourths of a second and the time between exposures eight to ten seconds. A residual film is made about ten minutes later. In cases of suspected ptosis a vertical film is taken after the last serial exposure.

The technic must be meticulous in detail. The roentgenologist must take time to prepare his eyes for proper fluoroscopy. The fluoroscopic part of the examination is not just an aid in the filling of the upper tract: much valuable information can be obtained as to fixity of the urinary passages, the type of peristalsis, the relation of extra-urinary shadows, the movements of the kidneys with respiration, and the passage of the media down the ureter. It is frequently necessary to change the position of the catheter by withdrawing it slightly. Our object is to place the catheters as high as possible, with the ideal position of the catheter being in the kidney pelvis proper. The urologic member of the team frequently places one or both catheters in the superior calyx—quickly remedied under fluoroscopic vision. With a little practice the roentgenologist is able to estimate very accurately by the size and density of the shadow the amount of the opaque medium which flows into the pelvis and calices. At times, fluoroscopy easily answers the query as to why the pyelographic film is incomplete, a subject which will be considered later.

When proper attention is paid to detail, we seriously disagree with the objections to the use of retrograde methods in the study of function. If the objection is confined to the use of stronger and more irritating solutions, to the use of the obstructing catheter with the injection from below, or to the use of pressure, we agree that it is unphysiologic. When non-obstructing catheters are used, when the injection is made slowly by means of gravity, when non-irritating solutions are used, and finally when the amount injected is carefully controlled by fluoroscopy, we believe, after two and a half years' experience, that the information obtained is accurate and reliable. If at any time pain in the back is produced, the roentgenologist considers that he has made an error in interpreting the screen findings. The so-called defense mechanism of pain should not be obtained if the procedure is properly carried out. When such reaction has been elicited with this technic we have found it in cases where the kidney pelvis was atonic.

Jarre and Cumming (4) speak of pro-

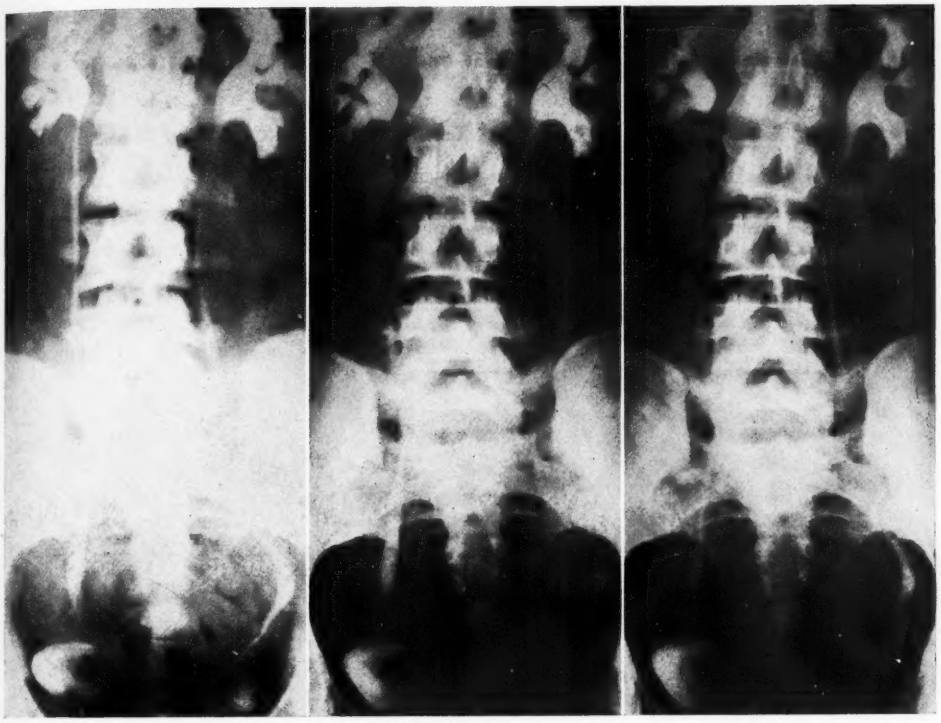


Fig. 1. Fig. 2. Fig. 3.

Figs. 1, 2, and 3. Serial films in case of bilateral ureteritis, showing fixity of lower ureters and dilatation above.

peristalsis as the normal finding and anti-peristalsis as the abnormal or pathologic. In our normal cases we expect to see this type of pro-peristalsis: where we obtain the anti-peristalsis with this method, roentgenographic evidence is obtained of pathology. These facts constitute an additional argument for soundness of properly made retrograde observations. They have certainly helped us on numerous occasions. When the opaque medium moves downward normally with no apparent reverse peristalsis or hyper-peristalsis and no apparent deviation in the rhythm, the examination is regarded as negative.

Elimination of pressure other than a small amount of gravity reduces to an absolute minimum the possibility of pyelovenous back-flow or of tubular injection.

There is one radiographic factor which is rarely mentioned and yet should receive emphasis. Many films showing blurred outlines of the urinary tract are presented in texts and articles, the usual explanation being that of movement of the patient, yet bony detail and other soft tissue detail may be good. The correct explanation—that the blurring is caused by movements of the intestines—is seldom given. The roentgen exposure should be fast enough to stop this peristalsis. Pyelographic films for proper detail should be made as rapidly as possible. We hope to attain an exposure time of a tenth of a second in the near future.

The entire urinary tract is routinely included in the examination, a method which we feel is essential. When examination of the gastro-intestinal tract is made more errors are caused by incomplete examination than from any other reason, a fact which holds good for the urinary

tract also. When the patient presents symptoms which call for a urologic survey, such a patient deserves a complete examination. Bilateral and complete examination, when proper methods are used, is not, in most instances, dangerous or disturbing to the patient. In our own cases the present technic of complete examination is attended with much less discomfort than resulted from the old method of unilateral examination using sodium iodide for the opaque medium. Many of the patients sleep through the procedure on their preliminary dose of morphine, except at the time the catheters are withdrawn.

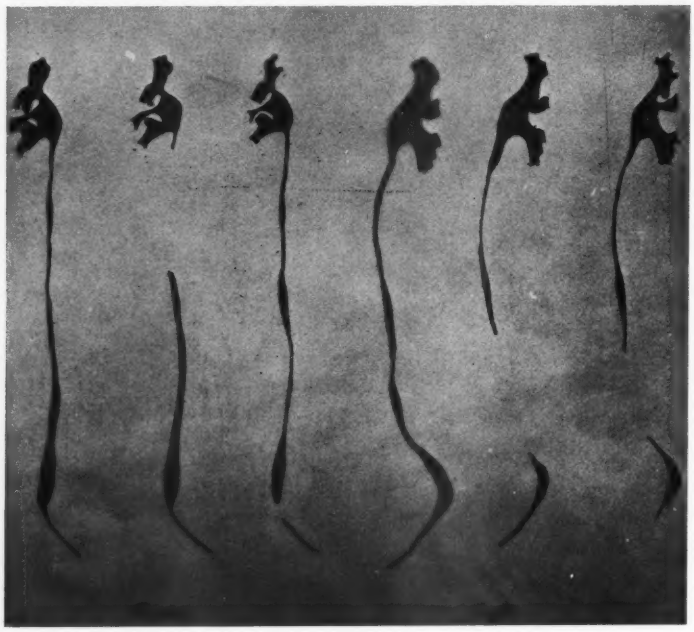


Fig. 4. Silhouettes of the films in Figures 1, 2, and 3, showing the changes of ureters, pelves, and calices in a graphic manner.

Case Report.—Patient A. P., female, aged 26 years. Chief complaint: Hematuria (intermittent). Cystoscopy: negative.

SUMMARY OF CYSTOSCOPIC FINDINGS

	Bladder	Right	Left
Smear	0	0	0
Culture	Sterile	Sterile	Sterile
Dye		4 min.	4 min.

Diagnosis: Bilateral ureteritis (Figs. 1–4).

Fluoroscopy is both a guiding hand and a safety valve for this technic. Overdistention can be prevented. In cases of atony we have frequently shown that it can occur with a pressure of gravity of 8 to 10 inches, while without fluoroscopy there is no method that will prevent such an occurrence.

The markedly hypertonic pelves and calices can be recognized fluoroscopically while from films alone the diagnosis of incomplete filling would be made. When the rapid contraction of such a pelvis is seen on the screen and passage of the opaque medium down the ureter traced, another interpretation of the film is made. We have seen such pelves and calices fill and empty in a fraction of a second, phenomena which cannot be recorded by present film technic.

With multiple exposures the films portray different parts of a physiological cycle, a change more marked than is usually appreciated. It is because of this change—it occurs in a matter of a very few

seconds—that we feel stereoscopic films to be of no value. In other words, each one of a stereo pair must present a different phase of the cycle, a fact which, of necessity, invalidates the stereoscopic examination.

At the same time, defects which are constantly present in several films are of much greater value than when seen on a single film. This is especially well seen in cases of non-opaque calculi; here the filling defects constantly present in the same location and of the same size are usually diagnostic.

Extra-urinary shadows are more easily evaluated in connection with complete visualization of the tract. This, we feel, is one disadvantage of the method of Moore.

Contrary to opinions expressed in the literature, multiple urograms showing the entire ureter have been of very valuable assistance in making diagnoses of pathology in the pelves and calices. An atonic or fixed ureter frequently calls attention to a more or less fixed pelvis which, on a single pyelogram, appears normal. Again a pathologic lower ureter may focus attention on a dysuric type of pelvis such as described by Rose, Hamm, Moore, and Wilson (8).

The change or lack of change in size of the calices and pelves gives us the most information. The hypertonic pelvis has been mentioned—if this is not too marked, the films will show it. The change in the calices and pelvis is visualized. Hypersecretion, which may cause an apparent rapid emptying that simultates hyperperistalsis, may cause error in interpretation, a fact to be noted by the urologist and warning given. Again, hypersecretion gives a slightly different picture fluoroscopically than hypertonicity.

In cases of block by stone or other pathology in the ureter the normal cycle is disrupted, which can be easily recognized on serial exposures. The fixed ureter shows clearly. Segmental dilatation can be differentiated from waves of peristalsis. Cases of stone show the accompanying ureteritis with this technic. The method has been helpful in the recognition of early tuberculous lesions, and we have also observed apparent attempts at peristalsis in advanced tuberculous ureteritis.

The so-called kinks of the ureter show as loopings of an elongated ureter: this, of course, does not include a fixed kink in the ureter due to inflammatory disease. With multiple films the so-called kink presents a different appearance on each film.

To us, the greatest value of this technic lies in the help it yields in recognizing inflammatory lesions. Jarre (4) has described an early hypo-peristalsis in acute infections. This we have not seen; however, none of our cases has been cystoscoped during the very acute stage. This observation of Jarre was obtained during intravenous pyelography which could be done safely during the acute period. Our early finding is a varying state of hyperperistalsis. This, as stated before, may be so marked as to prevent the securing of a good pyelogram, while later in the process the involved portion of the tract shows a fixed appearance, either in a state of dilatation or contraction.

This fixity is seen most commonly in lesions of the lower ureter. The constant finding of a narrow lower ureter, with the peristaltic waves coming down to but not through this area, is, we feel, diagnostic of a peri-ureteritis in this location. There may or may not be some dilatation of the ureter above this point. Such a condition is fairly common in adnexal disease of both male and female. Unless careful urograms are done this condition is missed entirely—with but a single exposure it is impossible to tell whether the narrowing is due to peristalsis or disease.

In conclusion, the method herein described is not final. We are continually adding to, and changing, our technic as our knowledge increases. A similar technic of rapid serial exposures is now being applied to intravenous examination. Plans have been made to increase the number of serial films and decrease the time between exposures, our aim being a practical routine

plan which will depict function as well as anatomy.

SUMMARY

A method of complete examination of the urinary tract is described.

The necessity for team-work between the urologist and the roentgenologist is emphasized.

A definite attempt is made toward functional as well as anatomic diagnosis.

For the writers, the technic constitutes a definite advance in routine diagnostic roentgenology in the field of urology.

BIBLIOGRAPHY

(1) NICHOLS, B. H.: Important Points in the Technic of Roentgenological Examinations of the Urinary Tract. Am. Jour. Roentgenol, 1923, **10,** 19.

(2) JARRE, H. A.: The Cinex Camera. Grace Hospital Bull., 1929, **13.**

(3) CUMMING, R. E.: Physiologic Data upon Renal and Ureteral Function as Recorded by the Jarre Cinex Camera. Jour. Urol., **25,** 613.

(4) JARRE, H. A., and CUMMING, R. E.: Pyeloperistalsis Characteristically Altered by Infection, with Notes on Functional Behavior of Other Hollow Viscera. RADIOLOGY, 1934, **23,** 299.

(5) MOORE, T. D.: A Simple Device for Serial Pyelo-ureterograms. Jour. Urol., 1931, **25,** 317.

(6) IDEM: The Value of the Serial Pyelograph in Diagnosis. Jour. Urol., 1932, **28,** 437.

(7) MANGES, W. F.: Pyeloscopy. Am. Jour. Roentgenol., 1918, **5,** 165.

(8) ROSE, D. K., HAMM, WILLIAM G., MOORE, SHERWOOD, and WILSON, HUGH M.: Kidney Pelves. Surg., Gynec. and Obst., July, 1933, **57,** 1.

UROLOGIC PROBLEMS IN CHILDHOOD[1]

By WILLIAM J. ENGEL, M.D., Cleveland Clinic, *Cleveland, Ohio*

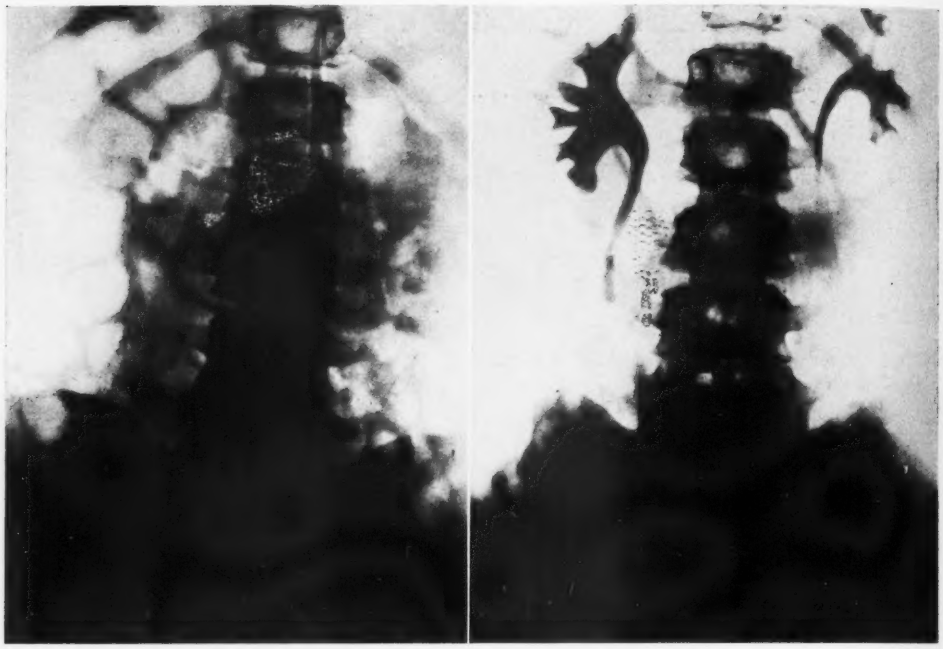
THE problems presented by diseases of the urinary tract in children have a right, I think, to be segregated from the other problems with which the urologist is confronted, not only because these diseases in childhood differ in many respects from those in adults, but also because attention is thus directed to lesions in the urinary tract in children which are all too often overlooked. Many phases of urinary diseases in children might be discussed, but I have chosen to emphasize certain problems relating to the upper urinary tract.

Urologic diagnosis in infants and young

[1] Read before the Radiological Society of North America, at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

Fig. 1. The patient was a girl, four and one-half years of age, who had had pyuria for three years. Roentgenogram shows a large calculus in the right kidney.

Fig. 2. The patient was a girl nine years of age. Roentgenogram shows calculous pyonephrosis of the right kidney and hydronephrosis of the left kidney, due to an aberrant artery.



Figs. 3-*A* and 3-*B*. The patient was a boy twelve years of age. Fig. 3-*A* (*left*). Plain roentgenogram shows a shadow in the region of the right ureter. Fig. 3-*B* (*right*). Intravenous urogram shows the shadow to be a calculus in the ureter. There is hydronephrosis of the right kidney.

children is rendered more difficult because of the impossibility of eliciting subjective symptoms accurately and because physical examination is so often unsatisfactory. The diagnostic methods, however, differ in no way from those employed in adults, and roentgenologic examinations play a major rôle in all cases. Every child who is suspected of having some disease of the urinary tract should have a preliminary stereoroentgenogram of the kidneys, ureters, and bladder, followed by additional studies according to the individual indications.

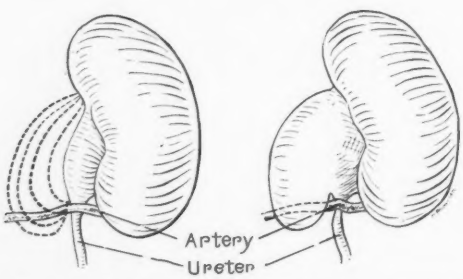
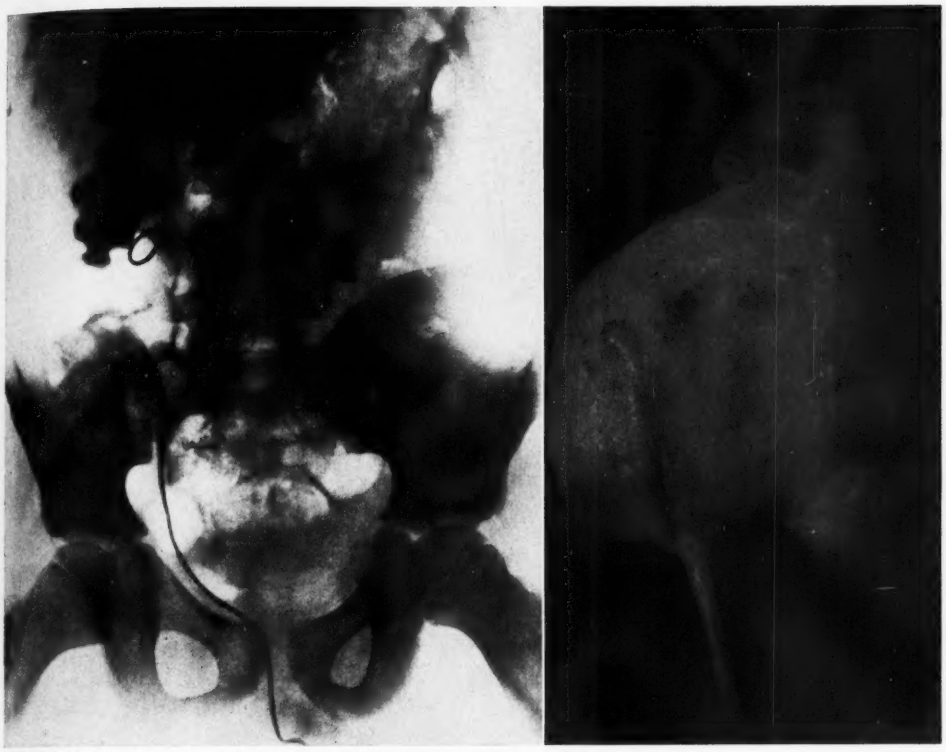


Fig. 4. Schematic drawing, showing successive stages of dilatation of the kidney pelvis over an aberrant artery.

When intravenous urography was introduced it was hoped that this would solve the problem of urologic diagnosis in children, but it has not completely met these expectations. Although it is employed more or less routinely as a preliminary investigation, it has been, on the whole, rather disappointing as regards final diagnosis and in many instances it has been necessary to resort to cystoscopy and retrograde pyelography before any final decision could be reached. This experience is supported by Campbell's recent report of 304 urograms in children, of which only 47.5 per cent were of diagnostic value and only 7 per cent furnished the correct diagnosis without further study. I do not mean to underestimate the value of intravenous urography. It has been of tremendous assistance, but one must be prepared to proceed further in that considerable group of cases in which intravenous urography does not yield conclusive diagnostic evi-



Figs. 5-*A* and 5-*B*. The patient was a boy nine years of age. Fig. 5-*A* (*left*). Retrograde pyelogram shows marked hydronephrosis and almost complete destruction of the kidney tissue. Fig. 5-*B* (*right*). Photograph of specimen, showing marked hydronephrosis due to aberrant artery which is well demonstrated.

dence. There should be no hesitancy in proceeding to cystoscopy, ureteral catheterization, and retrograde pyelography. Cystoscopy can be safely carried out, no matter how young the patient, and in gentle hands does not increase the hazard.

I shall now discuss some of the specific problems presented by the different diseases of the upper urinary tract in children. These may be grouped under three headings: (1) urinary calculi; (2) upper urinary lesions of congenital origin, under which I have included aberrant arteries, congenital megalo-ureter, and ureterovesical stricture, and (3) kidney tumors.

URINARY CALCULI

Urinary calculosis is not common in children when compared with the incidence of this condition in adults. In a series of 1,388 cases of urinary calculi seen at the Cleveland Clinic there were 17 cases in children under fifteen years of age, or an incidence of 1.2 per cent. As in the case of adults, stones may occur anywhere along the urinary tract. In our group of cases there were seven in the kidney, seven in the bladder, one in the bladder and kidney, two in the ureter only, and one in the kidney, bladder, and ureter.

The clinical picture differs in no way from that seen in the adult. Pain, of course, is the outstanding symptom. In children, however, this is much more frequently associated with rather marked gastro-intestinal symptoms, such as nausea and vomiting, and often muscle spasm of the abdominal wall. This may lead to considerable confusion in diagnosis and an intra-abdominal lesion often is suspected in these cases. The findings of pus cells

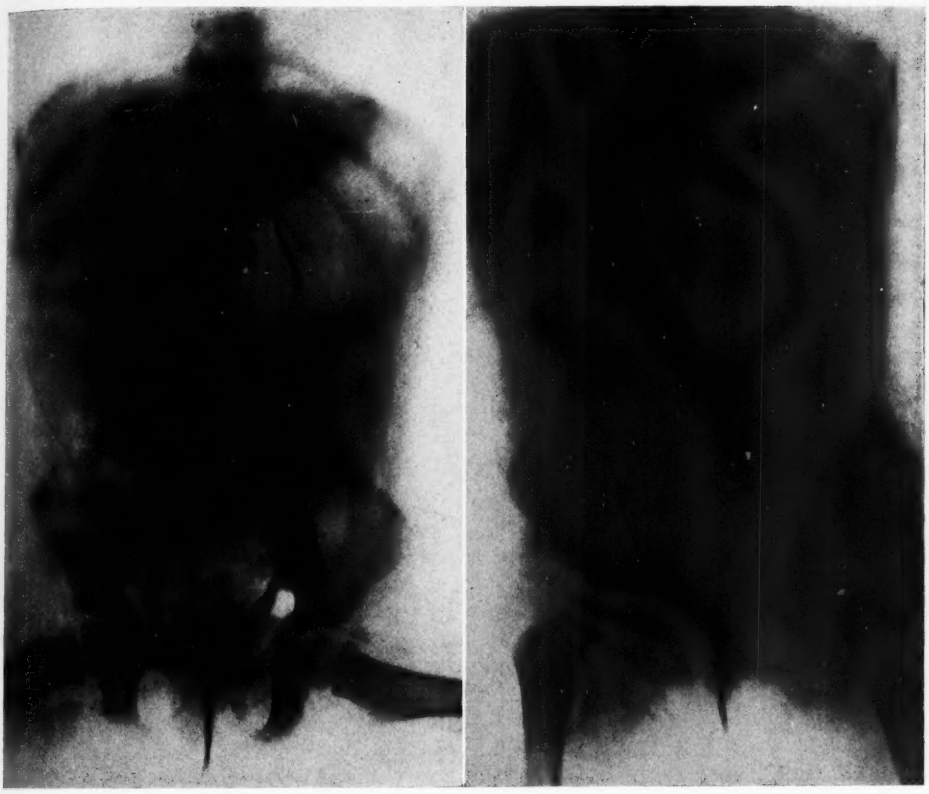
Fig. 6. The patient was a boy sixteen years of age. Roentgenogram shows bilateral hydronephrosis due to an aberrant artery.

Fig. 7. The patient was a boy fifteen years of age. Retrograde pyelogram shows hydronephrosis due to an aberrant artery. Complete relief of symptoms was experienced after conservative operation.

and red blood cells in the urine, however, should lead one to suspect the true nature of the trouble. Persistent pyuria, especially, should lead to the suspicion of kidney stones. In all cases in which this symptom is present, a plain roentgenogram should be made. This will show stones in the vast majority of instances (Figs. 1, 2, 3-*A*, and 3-*B*).

When there is a stone in the bladder the diagnosis is sometimes confused by the presence of urinary incontinence and enuresis. Some neurogenic cause of these symptoms is often wrongly suspected and an erroneous diagnosis of cord lesion or spina bifida may be made. The intense dysuria, however, should always suggest the possibility of stone in the bladder. The diagnosis, of course, is made finally by the finding of stone shadows in the plain roentgenogram of the kidneys, ureters, and bladder. Although this diagnostic method is available to practically every practising physician, it is amazing to see how often urinary stone goes unrecognized in children.

With improved knowledge of diet and infant feeding the incidence of stone in children has shown a sharp decrease in those countries where it formerly was quite prevalent. The work of McGarrison, Osborn and Mendel, Higgins, and others, showing that urinary calculi develop in a large proportion of rats fed on



Figs. 8-*A* and 8-*B*. This is a case of congenital megalo-ureter. The patient was a girl, three years of age, who had had chills and fever since she was four and one-half months of age. Fig. 8-*A* (*left*). Right pyelogram. Fig. 8-*B* (*right*). Left pyelogram shows bilateral dilatation of ureters. Bilateral vesicorenal reflux was demonstrated later by cystogram.

a diet deficient in vitamin A, forms the basis of this improved dietary management. Much has been accomplished in the way of prevention of stone in children, but there are unquestionably other factors beside diet which enter into the production of urinary calculi, and until these are elucidated, we cannot hope that urinary lithiasis can be prevented.

Treatment of urinary stones in children is almost entirely surgical. The type of operation, of course, depends upon the requirements of the individual case. Even in the case of ureteral stone, cystoscopic manipulation is often impossible in children and ureterotomy should be performed at once. The surgical removal of the stone, however, does not discharge the obligation of the urologist and he should then look to prevention of recurrence. It is here that the proper diet and high vitamin A intake achieve great usefulness. These patients should receive a high vitamin, acid ash type of diet, with the hope of forestalling recurrence of the calculi.

URINARY LESIONS OF CONGENITAL ORIGIN

Hydronephrosis due to aberrant artery is a relatively common disease and its recognition in childhood is a thing earnestly to be desired. Symptoms are not likely to appear early; the youngest patient we have encountered was a six-year-old boy. The incidence of aberrant renal arteries is, of course, much higher than that of cases in which there is a resultant hydroneph-

Fig. 9. The patient was a boy eight years of age who had had recurrent attacks of chills and fever, associated with pyelitis, since he was six months of age. Retrograde pyelogram shows dilatation of the kidney pelvis and ureter with ureterovesical stricture.

rosis. It has been estimated that aberrant renal arteries are present in about 20 per cent of all persons. Only 20 per cent of these, however, are at the lower pole and hence capable of producing urinary obstruction.

The embryologic explanation of the occurrence of aberrant vessels is that the kidney in its ascent to its final location receives its blood supply from successive levels, with obliteration of each previous artery. Failure of this process at the final level allows the vessel to remain patent, and if it is situated at the lower pole, is capable of producing urinary obstruction.

It would not appear that ptosis of the kidney or inflammatory stricture must be presumed in order to explain the production of hydronephrosis in these cases. These aberrant arteries are always associated with fibrous peri-ureteral bands, also of congenital origin, and the combination constitutes a fixed point which interferes with normal peristalsis. This results in gradual dilatation until finally the pelvis becomes redundant over this fixed point and this establishes a vicious cycle which increases the amount of obstruction (Fig. 4).

These cases are overlooked with striking frequency, a failure of recognition which is caused, I believe, by the usual absence of positive urinary findings. In fact, many of our patients with aberrant renal arteries have had perfectly clear urine. In a young person, persistent kidney pain, often most severe in the morning and waning through the day, with tenderness over the affected kidney, should always suggest the presence of this lesion. The pain is usually a dull aching and very seldom appears as colic. Gastro-intestinal symptoms may predominate. There is, of course, no way to make a positive clinical diagnosis without the aid of the roentgen ray. An intravenous urogram should be the first procedure and in almost every instance will yield a positive diagnosis. Of course, the intravenous urogram is of no value in those cases in which kidney function has been completely destroyed (Figs. 5-*A*, 5-*B*, 6, and 7).

Surgical intervention is demanded when this condition is recognized, and if the patient is seen before extensive kidney destruction has taken place, a conservative operation may be employed. We have preferred the simple division of the artery with or without plication of the dilated pelvis and have had completely satisfactory results by this method. All too often, unfortunately, the process has gone beyond the stage at which the conservative operation will suffice, and nephrectomy is required. In our series of 29 cases, nephrectomy was necessary in 50 per cent of the cases in which operation was performed.

Figs. 10-*A* and 10-*B*. The patient was a boy fourteen years of age. *A* (*left*) and *B* (*right*). Bilateral pyelograms, showing marked hydro-ureter and hydronephrosis (left). Obstruction in this case was due to congenital bilateral ureterovesical stricture.

Congenital megalo-ureter is a term applied to a small group of cases with bilateral ureterectasis which occurs in the absence of lower urinary obstruction. These cases must be differentiated from those with congenital posterior urethral valves, hypertrophied verumontanum, etc. That the condition must be congenital is apparent from the very early age at which it has been recognized, together with the fact that it may occur in the absence of any obstructive lesion. The exact mechanism of its production is not clear but it would seem to be due to some congenital neuromuscular failure, with persistence of a fetal type of ureter. It differs from hydroureter in obstructive lesions in that the latter is associated with hypertrophy of the ureteral musculature and marked tortuosity, an evidence of hyperperistalsis.

Urinary infection usually is responsible for bringing these patients for medical attention and this may appear when the child is very young. Recurrent infection is the rule, until the true nature of the disease is finally disclosed by a complete urologic investigation. At this time cystoscopy reveals wide patulous ureteral orifices which allow bilateral ureteral reflux. Injection of a pyelographic medium shows widely dilated ureters which, in the later stages, may be somewhat tortuous. Oddly enough, the kidney pelvis often shows only moderate dilatation, not at all comparable to the extent of dilatation in the ureter.

The treatment of this condition consti-

tues a real problem. Operation is of no avail and the task is to control the infection. Drainage by inlying ureteral catheter may be necessary in the more severe acute phases of infection, and periodic lavage of the kidney pelves is at times a useful procedure. I have always felt, however, that a minimum of instrumentation should be employed, and that an attempt should be made to clear up the infection by means of a ketogenic diet and urinary antiseptics.

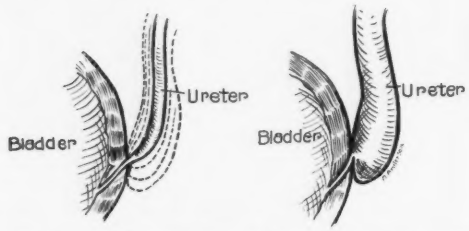


Fig. 11. Schematic drawing, showing how dilatation of the ureter above a ureterovesical stricture may produce valve-like deformities.

The prognosis in these cases is very bad and the patients almost never live to reach adulthood. There is a progressive kidney insufficiency, hastened by infection, and uremia is the terminal event (Figs. 8-*A* and 8-*B*).

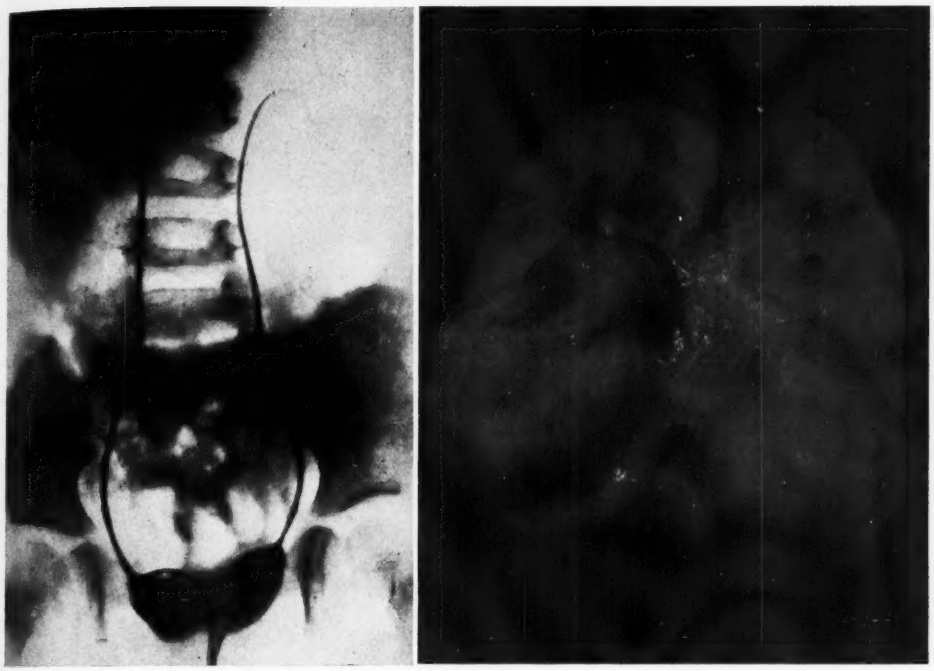
Ureterovesical stricture presents quite a different problem in that a definite obstruction caused by a congenital stricture at the vesical end of the ureter is the cause of the ureterectasis. These strictures may be unilateral, as in the case I present here (Fig. 9), but bilateral lesions of this type also occur (Figs. 10-*A* and 10-*B*). Cystoscopic examination in these cases reveals a small ureteral orifice in contrast to the large patulous ureter of congenital megaloureter. An attempt at ureteral catheterization may be attended with some difficulty. Similar cases have been described as due to congenital valves in the ureter, and though this possibility must be granted, I have a feeling that many cases in which the condition is attributed to the presence of valves, simply represent the dilatation of the ureter above a stricture which results in a valve-like appearance (Fig. 11). It is true, of course, that this resulting deformity acts to increase the amount of obstruction already present.

Here again, it is the presence of infection which demands medical attention. The infection usually is ushered in by chills and fever, and varying degrees of kidney pain and tenderness are constant accompaniments. The finding of pus in the urine usually results in a diagnosis of pyelitis, but repeated incidents of this type finally bring the patient for thorough urologic study. The intravenous urogram usually suffices to determine the diagnosis. This shows a dilated ureter with constriction at the lower end and usually retention in the kidney an hour after injection of the dye. In some cases there may be delayed function and the differential phenolsulphonephthalein test shows diminished function on the affected side.

The treatment consists in the surgical relief of the obstruction. Good results may be expected if the process is not too far advanced. The ureter may not return to its normal size, but if drainage is free the patient will be well and no further kidney damage will result. In late, neglected cases, ureteronephrectomy may be necessary.

MALIGNANT TUMORS OF THE KIDNEY

Malignant neoplasms of the kidney in children present one of the most depressing problems in urology because there is so little we can claim to have accomplished for these poor unfortunates. Fortunately the incidence of these growths is not high, it having been estimated that only one child in 1,600 is affected by a kidney tumor. However, among malignant tumors occurring in children, 20 per cent are in the kidney and among all cases of kidney tumors, the incidence in children is about 12 per cent. At the Cleveland Clinic since 1920 we have records of 32 cases of kidney tumor in children, 16 of which have been verified by operation and pathologic examination.



Figs. 12-*A* and 12-*B*. The patient was a girl three and one-half years of age, who, when she was admitted to the hospital, complained of hematuria, chills, and fever. Fig. 12-*A* (*left*). Retrograde pyelogram shows a filling defect in the lower pole of the right kidney. Fig. 12-*B* (*right*). Photograph of specimen removed showing a Wilms tumor, involving the lower half of the kidney.

It is not within the scope of this paper to discuss at length the theories regarding the pathogenesis or the pathology of these tumors, but a few remarks are pertinent to the subject. These growths are all mixed, undifferentiated tumors arising from embryonic tissue, and are characterized by very rapid growth. They present a varied pathologic picture and any one of a variety of forms may occur, depending upon the type of tissue which predominates. It is truly a problem of survival of the fittest and the strongest and most rapidly growing tissue elements take the field. This explains the many pathologic names applied to these tumors, but clinically they are a single entity, well known in their behavior, and may, from our standpoint, quite properly be grouped under one term—malignant kidney tumors of childhood.

These growths occur in very young children and have even been reported in fetuses and newborn infants. The vast majority make their appearance before the fifth year of life; some collected series show an incidence as high as 98 per cent, but in our group of cases only 70.8 per cent occurred in children under five years of age (Figs. 12-*A* and 12-*B*).

The presenting symptom or complaint is usually an abdominal tumor which has appeared rather suddenly and has grown rapidly. The longest history we obtained was of six months' duration and this patient had a very large inoperable tumor. Chills and fever are not uncommon and pain is a frequent complaint. Hematuria is a relatively infrequent symptom and occurred in only two of our cases.

The diagnosis usually offers no difficulty when one considers that about 90 per cent of the patients present themselves with a palpable tumor mass in the kidney region. Kidney tumor is by far the most common cause of a large tumor mass in a child.

In the remaining 10 per cent of cases, hematuria, kidney pain, and the symptoms of urinary infection should direct one's attention to the urinary tract and further investigation and pyelograms disclose the true nature of the disease.

The results of treatment of these tumors must impress all who have seen any number of these cases as very discouraging. No matter what treatment is adopted, that is, operation, irradiation, or both, the outcome is nearly always fatal and this usually within a very short time. It is truly remarkable to see how some of these large tumors melt under irradiation therapy like fat before the fire, but this, unfortunately, does not improve the prognosis, for they recur rapidly and become more radioresistant.

MALIGNANT TUMORS OF THE KIDNEY IN CHILDREN[1]

WITH A REPORT OF SIX CASES

By ERNST A. POHLE, M.D., PH.D., F.A.C.R., Professor of Radiology *and* GORTON RITCHIE, M.D., Assistant Professor of Pathology, University of Wisconsin Medical School, *Madison, Wisconsin*

INTRODUCTION

DURING the past four years 34 patients with kidney neoplasms have been admitted to the University Hospital, at Madison, Wisconsin; six of these occurred in children under the age of 6 years and some belonged in all probability to the group of embryonic tumors very often called Wilms' tumor of the kidney. Since they are not very common and present a rather complex problem to the clinician and as the literature does not offer much information concerning treatment, the cases seen by us will be analyzed and certain conclusions offered regarding roentgen therapy.

PATHOLOGY

The nomenclature of the tumors under discussion is a matter of some confusion at present. Before 1894, many authors reported tumors of the kidney consisting of varying types of cells; in that year, however, Birch-Hirschfeld (1), reviewing the literature and describing several cases of his own, gathered these various neoplasms into one group, the common characteristic being the occurrence of more than one type of tissue. The usual picture was that of tubular tissue combined with various types of connective tissue, both of an embryonal character. He called them, therefore, embryonal adenosarcomas.

In 1899 and the following years, Wilms (2) investigated thoroughly the structure of the renal mixed tumors and published a three-volume monograph on the subject. The greater extent of his publications and the shortness of his name have perhaps been factors in attaching his name to these tumors rather than that of Birch-Hirschfeld.

The designation, "Wilms' tumor," however, has come to be applied loosely—perhaps chiefly in a clinical sense—to any renal tumor of primitive or embryonal nature, and especially to those found in children. This usage has thrown somewhat into obscurity a type of neoplasm which, though rare in comparison with mixed tumors, occurs with sufficient frequency to warrant its consideration whenever the diagnosis of a renal tumor in a child is in question, namely, embryonic carcinoma. Ewing (3) discusses this as a separate entity, but mentions the possibility of its relation to the mixed tumors.

The mixed tumors occur chiefly in young children, usually under 10 years, though they are also found in adults. They are not infrequently bilateral, and occur in any part of the kidney. The size naturally varies with the age of the tumor at the time of its discovery. Since it is usually first detected as a palpable mass in the kidney region, it is generally described as a massive neoplasm. The tumor tissue is usually sharply demarcated, but may be infiltrative in character. The gross structure is extremely variable, and may include hemorrhage, necrosis, and cartilage or bone formation as special features. Invasion of the renal vein sometimes occurs and may be followed by early and widespread metastasis.

Microscopically the picture is even more variable. The common feature, as stated above, is the presence of both epithelial and connective tissue elements, each participating in the malignant character of the neoplasm. The epithelial portions consist characteristically of tubules, often abortive in nature, but suggesting kidney tubules.

[1] Read before the Radiological Society of North America, at the Twentieth Annual Meeting, Memphis, Tenn., Dec. 3–7, 1934.

The epithelium forming them is usually of high columnar variety, with a definite lumen and in some cases a well-defined basement membrane. On the other hand, all gradations of differentiation have been reported, from primitive-appearing groups of round cells, described as the mesodermal forerunners of renal epithelium, to abortive attempts at glomerulus formation.

The connective tissue elements may also present an exceedingly complex picture. Primitive connective tissue is always present, and this apparently is not in the least limited as to its power of differentiation, for the greatest variety of connective tissue types may be found. Fibrous connective tissue, elastic tissue, fat, bone and cartilage, and finally muscle, either smooth or striated, may appear, and many of these may be present in the same tumor. The most constant type is muscle, usually striated. This, in rather primitive stages, combined with epithelium forming imperfect tubules, presents the most frequently seen picture, although, as stated above, endless variety is possible.

Metastases are most often found in the liver and lungs, and their structure may be similar to that of the primary tumor, or may contain only one cellular element.

The question of histogenesis is at present unsettled. The origin of the tumors has been assigned to various sources, for instance, the Wolffian body (Birch-Hirschfeld) and the primitive mesenchyme (Wilms). It is probably wise, however, on account of the extreme variation of structure, to concur with Ewing in not postulating a uniform origin for all the tumors in this group.

SYMPTOMS

Tumors of the kidney in children produce, as a rule, no symptoms until the growth has reached considerable size. In contrast to hypernephroma, these highly malignant neoplasms seldom cause hematuria early in their course, and the absence of pain also tends to prevent their early discovery. Sometimes the patient's vague gastro-intestinal symptoms induce the parents to bring the child to the physician, who, on palpation, finds a good sized mass in the left or right abdomen (Cases 2 and 5). In an early stage, tumors on the right may easily simulate appendicitis (Case 2). It is also possible that a bulging of the abdomen may be mistaken for adipositas or a hernia (Case 4) or that sudden hematuria (Case 1) may reveal the true nature of the disease.

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

The diagnosis of a fully developed kidney tumor in a child is usually not difficult. The palpation of a large mass in the kidney region leaves little doubt as to its probable origin. In the differential diagnosis pyelography and intravenous urography are of great assistance; both can be carried out with relative ease in children. If enough kidney tissue has been destroyed, there is non-visualization of the involved side following intravenous injection of the dye. Retrograde pyelography shows filling defects of varying size and irregularity, sometimes also an abnormal position of the ureter. Even a single film of the abdomen may definitely localize the tumor mass within the kidney area. While it may be difficult to differentiate very large kidney neoplasms from retroperitoneal tumors of other origin, the clinical data, supplemented by the radiological findings, permit one to establish the diagnosis.

PROGNOSIS

The prognosis of kidney tumors in children is extremely poor. While an occasional patient may survive, it appears from all available data that the mortality is well above 90 per cent. Hyman (4) states that 17 of a total of 163 cases of kidney neoplasms belonged to the group of Wilms' tumor; only one of the 17 patients survived operation by a few years. Of nine patients with Wilms' tumor of the kidney seen at Roosevelt Hospital in New York, seven died within the first year following operation; one was alive after four years but could not be traced further. One patient (reported by White, 5), operated

on in 1925 at the age of seven months, was living in 1931. The experience of observers on the Continent is similar (Demel, 6).

TREATMENT

Before the advent of high voltage therapy the treatment of kidney tumors in children was entirely surgical. Since they are composed largely of embryonic tissue it seems logical to assume that they are radiosensitive. Clinical experience has indeed shown that marked reduction in size may be brought about by roentgen therapy. Only recently Randall (7) has drawn attention to this fact and recommended pre-operative irradiation in all cases of this type, followed by removal of the residual mass four to six weeks later. In two out of three cases the procedure proved to be of definite benefit. We feel that the interval between pre-operative irradiation and operation should be determined according to the individual requirements of each case, and find it impossible to propose a definite period. As soon as the tumor has been reduced to such an extent that it is barely palpable, and provided the general condition of the patient is satisfactory, removal of the remaining tumor may be attempted. Hyman, though he does not believe in irradiation of adult kidney neoplasms, also feels that pre-operative roentgen therapy is indicated in Wilms' tumors. We would like to emphasize the statement that prophylactic treatment should follow successful removal of any residual tumor mass.

The technic of treatment is simple. As a rule one anterior and one posterior field suffice; in very large tumors a third lateral field can be added. The question of dosage is a matter of debate. Randall used about 800 r over two areas applied during approximately two weeks; we have administered less in our patients. Even with relatively small doses we experienced violent systemic reactions—so severe as to force interruption of the treatment (Cases 1 and 2). A very poor general condition (Case 3) with a low blood count also renders moderate or small doses advisable. We see no particular objection to the use of smaller doses since we are dealing with a highly radiosensitive neoplasm. One must also remember that a too rapid breakdown of tumor tissue is very apt to produce severe symptoms of intoxication; the response of the tumors to irradiation in our own patients seems to bear this out. As to the prophylactic irradiation of the sites of future metastases we are somewhat reluctant to proceed. It is impossible to predict, for instance, how much benefit one may obtain from producing fibrosis in the mediastinal glands and thus depriving a patient of normal lymphatic tissue. To what degree such an area may be rendered non-fertile for the development of a metastatic lesion is beyond prediction.

In case of severe pain, roentgen therapy may bring palliation (Case 6) and is, therefore, indicated. We do not recommend treatment of the metastatic lesions in the lungs, although theoretically they should respond because of the radiosensitivity of the primary tumor. However, once the metastatic process has started, it seems to spread so rapidly that therapy appears rather futile. We are also very sceptical as to a "spontaneous" regression of a secondary neoplasm in the lungs.

REPORT OF CASES

Case 1. M. H., X-ray No. 1748, male, 5 years old, was admitted to the Wisconsin General Hospital, Section on Pediatrics (Dr. J. E. Gonce) on July 18, 1931. The parents had noticed that for two years (?) the boy's stomach was unusually large. They had not been especially worried about this, since he had no symptoms of any sickness during this time. A few days before admission to the hospital the patient passed bright red blood following urination. The boy was taken to a physician who found a tumor in the abdomen and advised hospitalization. The parents did not recall any symptoms which might have been related to this condition aside from a sallow color which had been present

at various times during the preceding two years. Past medical history included only whooping cough at one and a half years of age. The family history was irrelevant.

Physical examination showed a fairly well nourished and well developed boy. In the right side of the abdomen was a large, nodular, very irregular mass, extending from the costal margin down past the umbilicus and past the midline. It was very firm but not tender. It did not move with respiration and was quite immovable on palpation. Physical examination was otherwise essentially negative.

Urinalysis and routine blood count were normal. A phenolsulphonephthalein test was done and showed 45 per cent excretion in the first hour and 5 per cent excretion in the second hour. X-ray examination of the abdomen revealed a large tumor mass on the right side, apparently arising from the right kidney and displacing the intestines to the left; the left kidney was visualized partially. A pyelo-ureterogram was taken and showed a normal left kidney. There was a small amount of dye showing in the mid-portion of the right kidney. A diagnosis was, therefore, made of right kidney tumor, probably sarcomatous in nature. X-ray therapy was started immediately and given in as large doses as the patient would tolerate and as often as he would tolerate them. The following x-ray deep therapy technic was used; H.V.L. in Cu, 0.95 Å., 100 r (in air) per sitting, anterior and posterior right kidney area, one field per day. After three sittings the patient developed fever, nausea, and symptoms of marked intoxication. Treatment had to be interrupted for two weeks. In spite of the relatively small dose administered the mass appeared to be definitely smaller. Treatment was continued until six exposures had been applied over both anterior and posterior kidney areas. At the time of discharge from the hospital there was marked reduction in the size of the growth. The patient returned in November and again received six fields of 100 r (in air) each, both anteriorly and posteriorly. At the end of December no tumor mass was palpable. It was decided, therefore, to remove any residual mass surgically. The hemoglobin at that time was 60; there had been no loss nor gain in weight.

Operation, Jan. 5, 1932 (*Dr. I. R. Sisk*).—The kidney was exposed through the usual right flank incision. The neoplasm was larger than it had been thought, from physical examination, to be; it had developed in the upper pole and displaced the pelvis and remaining kidney downward. Considerable bleeding was encountered as a result of the friability of the renal vein. This, however, was completely controlled, and the kidney with the entire tumor was removed. Blood transfusion of 300 c.c. was given.

Histologic Examination.—The tumor is made up chiefly of acini of which some have a definite lumen and resemble tubules or glandular structures, while others are solid. The cells of the tubular acini are almost uniformly of very high columnar type. In the more solid acini, the cells are irregular in shape, though fairly uniform in size. They are not so elongated in general as in the tubular portions, but are more polyhedral in shape. The nuclei, in general, stain lightly, with only occasional nucleoli. The stroma consists for the most part of delicate strands of connective tissue carrying small blood vessels, though here and there heavier connective tissue septa can be seen containing large vessels. A heavy connective tissue capsule is present and in the histologic sections examined this has not been invaded (Fig. 1). A large part of the mass consists of a dense vascularized connective tissue matrix in which are embedded cells reminiscent of the polyhedral tumor cells described above, though not definitely identified as such. A few tubules lined with cubical epithelium are found here.

This may be described as a renal adenocarcinoma of somewhat primitive type, but is not a typical embryonic tumor of the kidney. The heavy connective tissue growth in some parts is characteristic of irradiated tissue, but certain portions of

the tumor do not seem to have been affected by roentgen therapy.

On Jan. 17, 1932, the patient developed a temperature of 102°; there was a small sinus at the site of the drainage in the wound. Another transfusion of 300 c.c. was given on January 18. The patient recovered sufficiently to receive additional x-ray deep therapy starting on Feb. 1, 1932. He returned on March 18, when he appeared to be in good physical condition. The parents stated that he had been acting as a normal child and was eating well. Examination showed a lump of large walnut size in the upper right iliac fossa, slightly movable and not tender on pressure. Treatment was instituted immediately, but when the patient returned in April he was cachectic (had lost weight, looked very anemic) and the tumor had slightly increased in size. He died at his home in May, 1932. No autopsy permit was obtained.

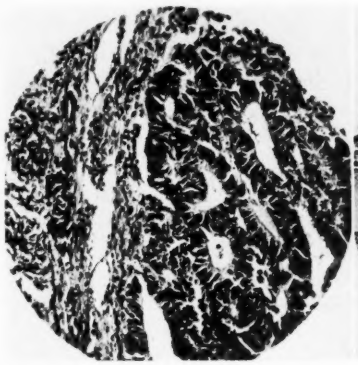


Fig. 1. Case 1. Photomicrogram of tumor removed following x-ray therapy (220 ×). For description see text.

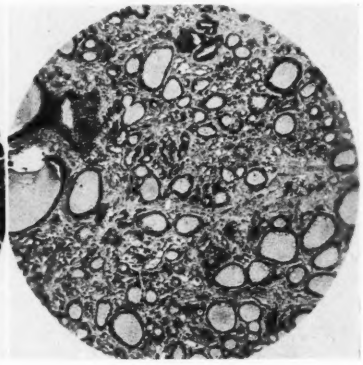


Fig. 2. Case 2. Photomicrogram of tumor removed following x-ray therapy (220 ×). For description see text.

Case 2. R. K., X-ray No. 1966, female, aged three and one-half years, was admitted to a Madison hospital on Dec. 15, 1931. The patient's mother stated that about Oct. 20, 1931, the child fell and complained of pain. On the following morning she began to vomit and in the afternoon had a temperature of 103 degrees and abdominal pain. A physician was consulted who suspected appendicitis. On October 22, the mother first noticed a mass on the right side, and on December 5 blood and pus in the urine. No dysuria, frequency, or nocturia. No history of childhood diseases. Birth weight had been eight and three-fourth pounds. The child had been gaining normally: intelligence good. Physical findings were essentially negative except that the right kidney was greatly enlarged, freely movable and not tender, extending almost into the pelvis. The liver was palpable 2.5 cm. below the right costal margin. The blood count showed slight anemia; albumin and red blood corpuscles were found in the urine. The child was referred by Dr. I. R. Sisk to the Wisconsin General Hospital for x-ray deep therapy. Five exposures of 100 r (in air) each were given over the anterior and posterior right renal area on five successive days. On Jan. 11, 1932, the tumor had so much decreased in size that surgical removal of the residual mass was carried out.

Histologic Findings.—This tumor is apparently greatly changed by irradiation, and therefore its original nature cannot be determined with certainty. It is composed of tubular acini of low cuboidal epithelium, with extensive edema and hemorrhage of the stroma. No mitotic figures

Fig. 3. Case 3. Intravenous pyelogram taken Nov. 13, 1934, showing functioning kidney on irradiated side. Note distortion of calices.

are seen, and there is very slight invasion of the capsule (Fig. 2). The picture is that of renal adenoma, but the development of lung metastasis, with rapidly fatal outcome, forces us to the diagnosis of adenocarcinoma of the kidney.

The patient returned on Feb. 5, 1932, for further x-ray therapy. Six sittings with the same technic as in the first series were given. The hemoglobin was 60 per cent and As-Fe medication was ordered. The patient returned for another series of treatments on March 16, 1932. After the second sitting she developed very severe nausea, with symptoms of intoxication, which made it impossible to continue treatment. She was brought back on April 11, 1932, but was in such weakened condition that treatment seemed inadvisable. There was no evidence of local recurrence at that time. The child died at her home on June 15, 1932. The family physician had diagnosed lung metastases on physical examination. The child had very little pain and remained in bed only four days preceding death.

Case 3. R. K., X-ray No. 1446, male, 10 months of age, was admitted to the Wisconsin General Hospital, Section on Pediatrics (Dr. J. E. Gonce), on Feb. 25, 1931, because of a tumor in the abdomen which had been noticed three months previously. The infant had been apparently normal in development since birth. At the time of admission he weighed nearly 21 pounds.

Physical examination was essentially negative except for the presence of a very large, firm, irregular tumor on the left side of the abdomen, extending from the costal margin to about 4 cm. below the umbilicus. It extended past the midline toward the right and was not freely movable. X-rays were taken and intravenous pyelography performed which permitted the diagnosis of a kidney tumor. Because of a marked secondary anemia an intraperitoneal transfusion was given on March 9, 1931. On March 17, 1931, under general anesthesia, laparotomy was performed by Dr. I. R. Sisk, revealing a very large embryonic vascular type of tumor over the left kidney which filled half of the abdomen, extending to the diaphragm above and into the pelvis below. The right kidney appeared to be normal. The tumor could not be excised since it was densely adherent to the aorta, besides being extremely vascular. No tissue was, therefore, removed for histologic examination. The incision was sutured and allowed to heal. The prognosis in this case was considered quite hopeless. X-ray therapy was applied in relatively small doses because of the extremely poor condition and young age of the child (blood count on March 28,

1931: 42 per cent hemoglobin; 4,180,000 red blood cells; 13,050 white blood cells). Every day for six days 50 r were given over the anterior and posterior left kidney area, beginning on April 1, 1931. This was followed by saturation on April 23 and on May 11. (Total dose in air, 750 r over anterior and posterior kidney area.) In June the blood count had improved and the mass was less than one-half of the original size. Roentgenograms of the chest were negative for metastases. Additional irradiation was given in July and September. At that time the residual mass was barely palpable. In January, 1932, no mass could be palpated. A severe respiratory infection prevented operation at that time. On June 30, 1932, the left kidney was explored through a left flank incision. The kidney itself appeared practically normal in size and quite normal in appearance. There was, however, an extension of the tumor along the pedicle over to the large blood vessels. It was hard and about 1.5 inches in diameter. Nephrectomy did not offer much benefit as a curative measure, because the above described extension along the vessels could not be entirely removed. No attempt was made, therefore, to remove the kidney, and the wound was closed without drainage. X-ray therapy was continued and series of treatments given in July, 1932, in January, February, and May, 1933, and in January, 1934. The patient was last seen on Nov. 14, 1934. There were no signs of recurrence or metastases. The intravenous pyelogram (Fig. 3) revealed a functioning left kidney, although there appeared to be a definite distortion of the calices. Roentgenograms of the chest did not show any abnormalities and the general condition of the boy seemed to be excellent three years and eight months after starting x-ray therapy.

Case 4. C. T., X-ray No. 1493, female, 4 years old, was admitted to the Wisconsin General Hospital on April 3, 1931, Section on Pediatrics (Dr. J. E. Gonce). About four months previous to the patient's admission the parents noticed a mass in the right upper quadrant. They thought it to be a rupture and applied a bandage, without results. A physician was consulted who diagnosed a tumor in the abdomen and referred the patient to the hospital. Examination showed a large protruding mass in the right upper quadrant which appeared to be firm, irregular in outline, movable, not tender, and apparently unattached. It extended from the costal margin down to 4 cm. below the umbilicus and from the right lateral abdominal wall to the mid-line. Other physical findings were essentially negative. X-ray examination of the abdomen on April 4, 1931, showed the left kidney apparently normal in size and position. Outline of right kidney was not seen. Entire right side was obscured by a large mass of fairly regular outline. Intravenous pyelograms on April 7, with skiodan, revealed normal outline of left kidney and ureter. The right kidney showed only as a small pelvis in the upper portion of a large mass filling the entire right side. On April 9 the peritoneum was opened through a right rectus incision (Dr. I. R. Sisk). A large lobulated tumor of the right kidney was exposed, but was found to be too extensively attached to the surrounding tissues to permit removal. X-ray deep therapy was started on April 23, 1931. Although only 50 r were given over each field, a severe reaction developed after the second treatment and the temperature rose to 103°. X-ray therapy was resumed on April 27 and completed on May 7, 1931. A total of 525 r (in air) were given over anterior and posterior right kidney areas. The patient returned for further treatment in May; at that time the hemoglobin was only 48 per cent. On June 10 roentgenograms of the chest showed metastases (Fig. 4). The patient died a few weeks later at her home. No autopsy permit was obtained.

Case 5. D. S., X-ray No. 2888, female, 3 years old, was admitted to the Wisconsin General Hospital, Section on Pediatrics (Dr. J. E. Gonce), on March 16, 1933. The family and past histories were not

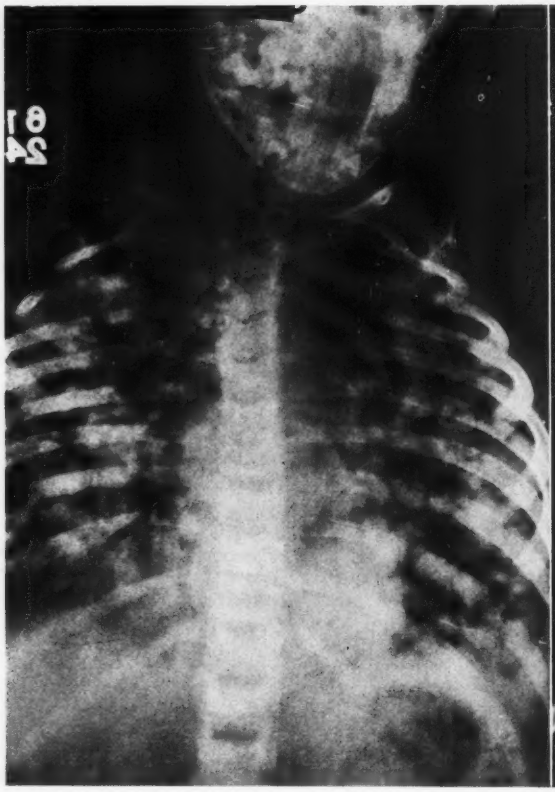


Fig 4. Case 4. Roentgenogram of chest taken June 10, 1931, showing metastases in lungs.

Fig. 5. Case 5. Intravenous pyelogram taken Feb. 22, 1933. Arrow points to small amount of dye on involved side.

relevant. The present condition began on Feb. 14, 1932, when the patient suddenly fell to the floor without losing consciousness. She vomited immediately after this and appeared to have a fever. Vomiting continued for several days and the patient then began to complain of pain in her left side, at which time a tumor mass was noted. The parents remembered that the child had complained vaguely of a fullness in the abdomen on the left side since December, 1931. In the two months before admission the child had lost seven pounds in weight, and her appetite had been very poor. Nothing unusual had been noticed about the stools or urine except that the urine was somewhat scant in amount. The family physician examined the child in September, 1932, at which time there was no abdominal mass present. Two months later, however, a large tumor could be palpated. Physical examination showed a poorly nourished, pale infant, who was lying quietly in bed, appearing to be prostrated and very weak. Examination of the abdomen revealed a prominence in the upper left quadrant of the abdomen. A large tumor mass was palpable, extending past the mid-line on the right and inferiorly down beyond the umbilicus; very firm, with rounded edges. On the medial aspect no notch could be palpated. The upper pole of the mass seemed to fade out under the costal margin. It was not movable, did not change position with respirations, and did not seem to be particularly tender. Physical examination was otherwise essentially negative. X-ray

studies of the chest showed no evidence of tumor metastases or other pathology. X-ray examination of the kidneys, ureter, and bladder was unsatisfactory aside from showing the mass described above. An intravenous pyelogram was performed on Feb. 22, 1933, and a normal kidney and pelvis were visualized on the right side. On the left, a dense large mass was present with no dye visible except in one small area below the twelfth rib. A small amount of dye was seen in the lower end of the left ureter (Fig. 5). The urine was essentially normal. The blood count showed a marked secondary anemia. A leukocytosis of about 20,000 was present, with an increase in neutrophiles to 70 per cent. Phenolsulphonephthalein excretion was 60 per cent in two hours, 40 per cent of which was excreted in the first hour. A diagnosis was made of a malignant tumor of the kidney, probably of the embryonic type. X-ray deep therapy was started on Feb. 23, 1933; 50 r (in air) were applied to the anterior and posterior left kidney areas on six successive days, and saturation twice at intervals of ten days, giving a total of 600 r (in air) over anterior and posterior fields. In April the tumor had decreased to about one-fourth of the original size. At the return in May, the tumor appeared to be larger again, and while physical examination of the chest seemed negative and there were no symptoms, roentgenograms showed definite metastases. The patient died on May 28, 1933, no autopsy being performed.

Case 6. Y. H., X-ray No. 3585, female, age 2 years, was admitted to the Wisconsin General Hospital, Section on Pediatrics (Dr. J. E. Gonce), on Dec. 20, 1933. In the latter part of August, 1933, the parents noted a growth in the abdomen producing a bulging in the region of the stomach. The tumor increased in size very rapidly. Vomiting after meals began, the appetite decreased, and the child gradually became weaker. In September, 1933, the right kidney tumor was removed at a hospital in La Crosse, Wisconsin, and diagnosed sarcoma. The tumor weighed two pounds.

Histologic Findings.—The tumor cells

Fig. 6. Case 6. Photomicrogram of tumor removed at operation. No preceding x-ray therapy (220 ×). For description see text.

for the most part resemble those of a large spindle-celled sarcoma, but here and there are groups which present an appearance which suggests that they may at one time have formed tubules. In some areas vacuolated cells (fat cells?) are seen, presumably the result of the invasion of fat tissue by the neoplasm (Fig. 6). The kidney tissue itself has undergone extreme fibrosis, with corresponding atrophy of the parenchyma. The tubules are everywhere dilated, with a very low cuboidal epithelial lining. In the cortex they contain hyaline material and sometimes a few leukocytes, while in the medulla they stand open and apparently empty. In the glomeruli there is great shrinkage of the capillary tuft, with pyknosis of the endothelial nuclei and thickening of the capillary basement membrane. The conclusion is drawn that this is a mixed tumor (adenosarcoma).

Following the operation the child's appetite improved and she gained in weight. However, in November she became irritable and complained of pain in the stomach. A recurrence could be felt on the right side of the abdomen about the size of an apple.

Physical examination showed a poorly nourished, rather pale female child who

weighed 28 pounds. Examination of the abdomen revealed a definite bulge on the right; palpation disclosed a very large, firm, irregular, non-tender, and non-pulsating mass which extended medially well past the mid-line, upward to the costal margin, and below to the iliac crest. Physical examination was otherwise essentially negative. Urinalysis showed no pathology. The hemoglobin was only 50 per cent, with 4,500,000 red blood cells and 10,000 leukocytes. X-ray examination of the chest showed no evidence of metastases.

X-ray therapy was started on Dec. 21, 1933. Within one week, a total dose of 500 r was given over the anterior and posterior right kidney areas. The general condition of the patient, however, remained poor. In February there was marked cachexia and the tumor had increased in size. Another series of treatments was given at that time. The child complained of severe pain in the right upper quadrant, which was relieved completely by irradiation. Roentgenograms of the chest taken on Feb. 20, 1934, revealed definite metastases in the lungs. The patient died on March 6, 1934. No autopsy was permitted.

DISCUSSION

An analysis of our six cases impresses us above all with one fact, and that is the high malignancy of these neoplasms. Operation alone or in combination with irradiation seems ineffectual in eradicating the disease. A striking temporary improvement is followed soon by either a local recurrence or widespread metastases leading to death. According to our experience, the lungs seem to be the most frequent site of secondary involvement.

Another observation worthy of mention is the fact that a tumor may almost completely disappear following roentgen therapy, so that palpation cannot definitely outline any mass in the kidney area. Yet, laparotomy often reveals a fairly large residual tumor. In our experience preoperative irradiation did in no way complicate the surgical procedure.

It was most surprising to find that the only surviving patient (Case 3) had received only roentgen therapy; no removal of the tumor or nephrectomy was carried out at operation. We are unable to explain this fact, and refuse to draw the obvious conclusion. We are still inclined to believe that pre-operative irradiation and removal of the residual neoplasm, followed by post-operative irradiation, is the most logical method of treatment.

Another interesting phenomenon in this patient was the preservation of the kidney function on the irradiated side as proved by the intravenous pyelogram. While it is well known that heavy doses of roentgen rays produce severe injury to the kidney (Hartman, Bolliger, and Doub, 8) apparently the total dose administered in our case was not sufficiently high to impair secretion. Our material does not permit any conclusions as to the relations between radiosensitivity, prognosis, and histologic picture. One may safely assume, however, that tumors consisting of young and undifferentiated cells will respond quickly to irradiation but are also most apt to recur soon. There seems little hope of improving the prognosis at present since early diagnosis is extremely difficult because of the absence of characteristic symptoms, an observation made in all cases reported by us.

SUMMARY

1. Six cases of kidney tumors in children are reported; in three instances histologic studies of the neoplasm were available. Their pathology, diagnosis, and treatment are discussed.

2. The treatment consisted of operation and roentgen therapy. Five patients died from the disease within two years after the diagnosis was made. One patient, who received only roentgen therapy, is still well and without demonstrable metastases three years and eight months following treatment.

3. In our opinion the most logical treat-

ment is pre-operative irradiation followed by surgical removal of the residual mass if possible and roentgen therapy post-operatively. The optimal time of operation should be determined in each individual case; we cannot advocate any specific period.

BIBLIOGRAPHY

(1) DÖDERLEIN, A., and BIRCH-HIRSCHFELD, F. V.: Zentralbl. f. d. Krankheiten d. Harn- and Sexualorgane, 1894, **5**. (Cited by Hedren, G., in Ziegler's Beitr. z. path. Anat. u. z. allg. Path., 1907, **40**, 1.)
(2) WILMS, M.: Die Mischgeschwülste der Niere, 1899, 1900, 1902, **1–3.**
(3) EWING, J.: Neoplastic Diseases. Third Ed., 1928, p. 796.
(4) HYMAN, A.: Surgical Clinics of North America, 1933, **13**, 347.
(5) WHITE, W. C.: Ann. Surg., 1931, **94**, 139.
(6) DEMEL, R.: Bruns' Beiträge zur klin. Chir., 1933, **158**, 527.
(7) RANDALL, A.: Ann. Surg., 1934, **100**, 462.
(8) HARTMANN, F. W., BOLLIGER, A., and DOUB, H. P.: Jour. Am. Med. Assn., 1927, **88**, 139.

DISCUSSION FOLLOWING SYMPOSIUM ON UROLOGY

DR. B. H. NICHOLS (Cleveland): It has been our object, in preparing this program, to try to bring to you a cross-section of the present status of the relation of radiology to urology, both in diagnosis and therapy, and we will proceed with the program.

DR. E. A. POHLE (*closing*): In closing, may I urge you to be very reluctant in refusing treatment to any of these children who come to you with these highly malignant kidney neoplasms, even if the patient is not in what we call good condition for irradiation. It is impossible to predict which one of those will respond and give you as satisfactory a result as this one patient of ours who is living now nearly four years after we started therapy.

DR. RUSSELL A. HENNESSEY (Memphis, Tenn.): I consider it a privilege to discuss some of the urologic problems of the roentgenologist, for I know of no one upon whom the urologist is more dependent in modern urologic diagnosis. He is, to be sure, the urologist's most dependable ally. It is true, however, that he will often see conditions which are most disconcerting and require a most careful urologic investigation to deny.

I prefer to discuss the value of intravenous urography, particularly as it applies in the recognition of obscure urologic anomalies. It is well known, of course, that the kidney which is functionless from any cause will not concentrate the intravenous urographic medium. By the use of intravenous urography, it has been possible to delineate or infer such congenital defects as fusion anomalies, renal hypoplasia, renal aplasia, and congenital absence of one kidney, conditions which were previously not possible of demonstration by cystoscopy or other diagnostic methods than surgical exploration. In four instances, we have been able by its use to imply the congenital absence of one kidney. The lack of concentration of one area furnishes only relative information, however, and it is only by the correlation of clinical findings that such inference may be proved.

Associated genital defects, occurring in 70 per cent of such cases, is the next most important clinical finding to make such diagnosis possible. We have been able to show the value of intravenous urography in these cases by proving the congenital absence of one kidney or a renal hypoplasia by subsequent surgical exploration in four of six cases we have seen.

A hypoplastic kidney may be capable of sufficient function to furnish a clear enough pyelogram to make diagnosis possible. The inability of the aplastic kidney to concentrate or excrete places it, so far as intravenous urography is applicable, in the class of the agenesic kidney.

Freely acknowledging the value of intravenous urography in urologic diagnosis, we have found, nevertheless, that it does not entirely supplant retrograde urography, particularly in detecting early pelvic changes produced by tumors of the renal parenchyma or kidney pelvis, or early renal tuberculosis. It is conceivable that further refinements in its chemical make-up and further experience in its usage will broaden the scope of its application and diagnostic value.

DR. GEORGE LIVERMORE (Memphis, Tenn.): I deem it a privilege to appear before this body, for, as Dr. Hennessey has so ably stated, we depend upon you so much for our diagnosis in urologic conditions.

Excretion urography is not only a great help but it fills a long-felt want in bringing out details that we have been unable to obtain by means of retrograde pyelography. On the other hand, retrograde pyelography brings out details that we cannot obtain by intravenous urography.

As the first essayist stated, we know that the reaction following cystoscopy is at times not very pleasant. However, there are many cases in which a diagnosis is impossible without retrograde pyelography, and I think the first speaker was perhaps a little too dogmatic in his statements, because if it goes out generally that a diagnosis can be made so easily by intravenous urography, I am sure it will result in causing a great many very bad diagnostic errors.

I think that excretion urography replaces a long-felt want but in no sense displaces retrograde catheterization; the fact, too, that we can always tell the condition of the two kidneys from a functional standpoint, and also obtain the urine from each kidney for microscopic examination and culture makes retrograde pyelography more valuable than intravenous.

Kidney function has been said to be demonstrated by intraveous urography, but this is not always true. We have recently had a case in the hospital in which no pyelogram was shown of the left kidney and no outline of the pelvis or ureter at all could be seen, and yet the right pelvis and ureter were clearly demonstrable.

On retrograde catheterization, however, the function by P.S.P. of the left kidney was 15 per cent in fifteen minutes, and 10 per cent of the right kidney; therefore, in this case it certainly did not demonstrate the function of left kidney.

I have found diodrast by far the best preparation for intravenous urography. Children are subject to the same urologic problems that affect the adult with the exception of hypertrophy of the prostate and pyelonephritis of pregnancy. In ureteral valves and hypertrophy of the verumontanum, however, we frequently have the same character of obstruction that occurs in hypertrophy of the prostate.

In the case of a boy, six years of age, who came to me for hematuria, a pyelogram was made simply by filling the bladder with the pyelographic medium and putting the child up in the Trendelenburg position. It shows a large hydronephrosis, with a dilated and tortuous ureter on both sides. This was the result of a valve in the ureter and a fibrosis of the bladder neck, causing obstruction and back pressure exactly as it occurs in hypertrophy of the prostate. By opening up this child's bladder, cutting the valve, and removing a wedge-shaped piece from the neck of the bladder, he was entirely relieved. He is now twelve years of age, goes to school every day, and is apparently well.

Children can be cystoscoped with the same degree of accuracy and the same degree of precision as in the adult and with far less reaction.

In the case of a boy baby, eleven months old, whom we cystoscoped recently, the film shows the catheter in the right ureter going away over to the left side. This made me suspect that he had one of those anomalous, ptosed kidneys or a congenital single kidney with two ureters. When we made the pyelogram, however, the catheter was in the pelvis of the left kidney with practically a normal pelvis on that side, whereas on the right side, the catheter is drawn away over to the left on account of the extreme dilatation and tortuosity of that ureter. The patient was relieved by nephrectomy.

I mention another case of a boy baby, eleven months old. The catheter was seen to be coiled up inside the hydronephrotic sac and only the upper portion of it filled. This child had practically no urinary symptoms except an occasional pus cell in the urine. He had been running a little temperature when he had pus; when the pus cleared up, the temperature would subside.

He had been treated for pyelonephritis since he was two months old. He was cured by nephrectomy.

It is very easy to catheterize children if they are under an anesthetic. There is only one contra-indication to cystoscopy in children and that is a high blood urea and creatinin and a very low P.S.P. output. We have small cystoscopes designed by many different urologists, so that sex and age are now no bar to cystoscopy in children. I have cystoscoped and pyelogramed a baby three days old.

DR. A. E. JONES (*closing*): I will answer my friend and colleague, Dr. Livermore, by saying that perhaps I was a little bit too dogmatic, and asking him to take into account the title of my paper. "The Superiority of Intravenous Urography over the Retrograde Method in Certain Well-defined Cases." I tried to confine myself to those cases in proving my point.

As far as Wilms' tumor is concerned, I enjoyed that presentation very much because we had a chance of seeing four of these cases in the last year, and, by the way, the patients are all dead—I don't know whether or not the radiation produced metastasis. It certainly does shrink the tumor, but there are some men who earnestly believe that it has something to do with producing metastasis.

THE IMPORTANCE OF ROENTGEN GASTRIC FUNCTIONAL STUDY IN THE DIFFERENTIAL DIAGNOSIS OF PYLORIC LESIONS[1]

By PROFESSOR WILLIAM H. MEYER, M.D., *New York City*

From the Department of Radiology, New York Post-graduate Medical School of Columbia University

PRELIMINARY

BEFORE proceeding with a discussion of the material at hand I should like to present ten illustrations selected from the 101 cases in which operation and biopsy follow-up were obtained, and ask you to tax your imaginations and personal diagnostic abilities before noting the pathologic conclusions.

FIGURE 1

The odd case in Figure 1, labeled No. 101 (not one of the pyloric series), which is obviously a neoplastic invasion of the pars cardia, was that of a young girl, aged 16 years. The pathologic interpretation is that of a *congenital mesenchymatous tumor.*

Case 2 (Fig. 1), which shows extensive neoplastic invasion of the pars pylorica, is pathologically reported as a *Krukenberg tumor and metastatic carcinoma of the ovary.*

Case 3 (Fig. 1), which in its radiologic aspect is somewhat similar to Case 2, is pathologically labeled *lymphoblastoma* (probable Hodgkin's disease).

Case 4 (Fig. 1) shows extensive gastric wall infiltration with several niches. The pathologic report is that of *primary sarcoma* with multiple ulceration.

FIGURE 2

The similarity of the location and character of lesions (Fig. 2, Cases 5 to 10) are obvious. However, in Case 5, the defect at the pylorus is evident; because of the functional behavior the lesion was radiologically interpreted as probably not malignant but rather as a papilloma with partial hypertrophic stenosis. Surgically and pathologically the lesion is reported as invagination of *hypertrophic mucuous membrane fold.*

(Fig. 2, Case 6). Notwithstanding the rather wide defect at the pylorus, the atony, dilatation, marked and prolonged retention, hypomotility and irregular peristaltic action suggested *hypertrophic* pyloric stenosis from an old ulcer, and the lesion was so interpreted. This was surgically and pathologically confirmed.

In Case 7 (Fig. 2), the radiologic examination suggested probable malignancy. It was because of the gastric shrinkage and other strongly supporting functional changes that this interpretation was made. Following resection, the pathologic conclusion is that of *malignant ulcer.* However, in the detailed description the pathologist observes an extensive lymphocytic infiltration of undetermined character (the case is still under observation).

In Case 8 (Fig. 2), the patient was a male, 30 years of age, in good physical condition but with the history of a possible chancre. Furthermore, because of the functional behavior and character of the pyloric defect, a roentgen interpretation of probable syphilitic hypertrophic pyloric infiltration was made. Microscopic examination of the resected pylorus showed *military nodular infiltration* with *tuberculous ulcer.*

Case 9 (Fig. 2) was both clinically and radiologically quite similar to Case 8 (Wassermann negative). A similar roentgen interpretation of hypertrophic pyloric infiltration was made. The pathologic report indicates *syphilitic hypertrophy and ulcer.*

Case 10 (Fig. 2) is of interest mainly from the clinical standpoint. The patient was a well nourished young man, 35 years of age, in good physical condition except for recent moderate gastric distress. The

[1] Presented before the Radiological Society of North America, at the Twentieth Annual Meeting, in Memphis, Tenn., Dec. 3-7, 1934.

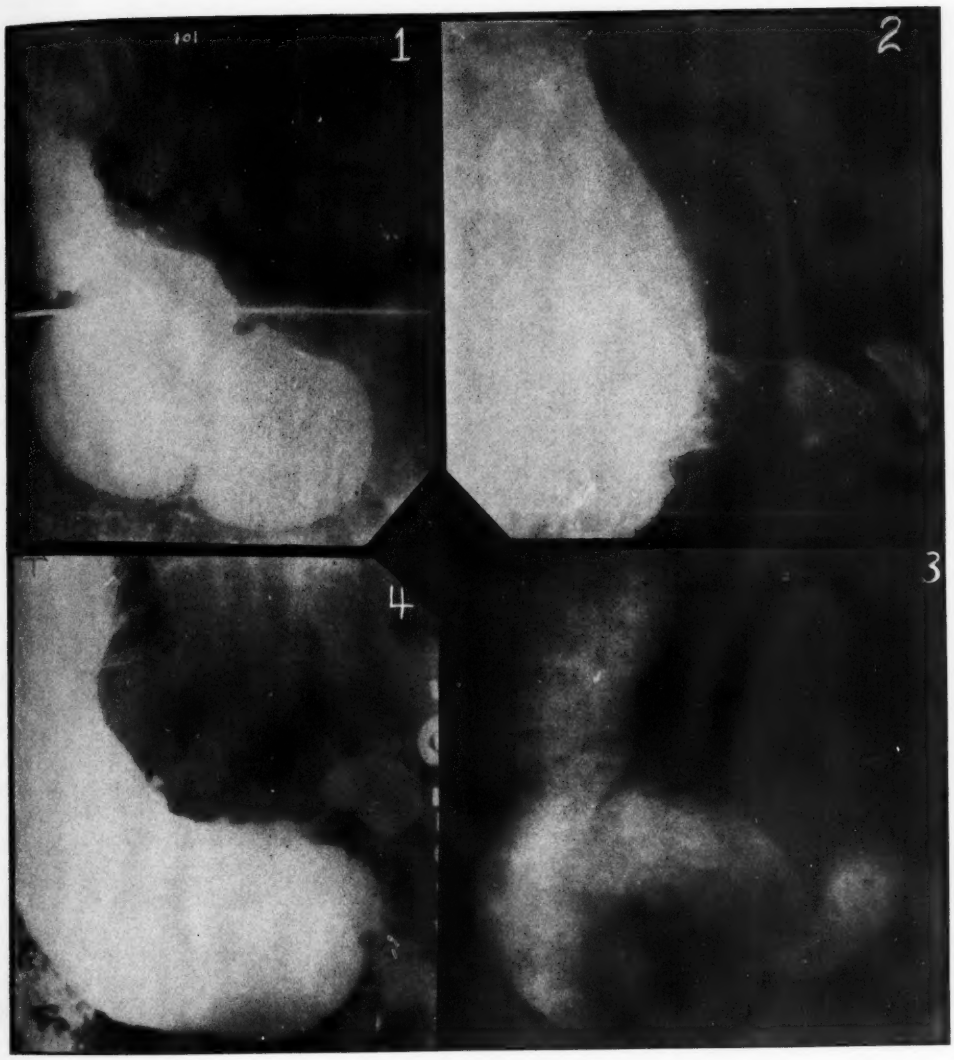


Fig. 1. Cases 1, 2, 3, and 4.

physical examination was negative except for a slight anemia. Notwithstanding the roentgen interpretation of malignant pyloric infiltration, the medical department insisted on a course of treatment on a clinical diagnosis of benign ulcer: not so much because of the positive roentgen diagnosis, but mainly since the case was primarily that from a surgeon. A subtotal gastrectomy for *pyloric carcinoma* ensued and this was pathologically confirmed. There was no evidence of metastasis at the time of operation. The patient was readmitted three months later, at which time he died of extensive pulmonary metastasis.

Morphologically, the radiologic uncertainties of true histo-pathology approximates 10 per cent. A correct interpretation, differentiating benign from malignant lesions, is made in nine out of ten cases. Yet in 400 cases, holding the same proportions, 40 uncertainties are a

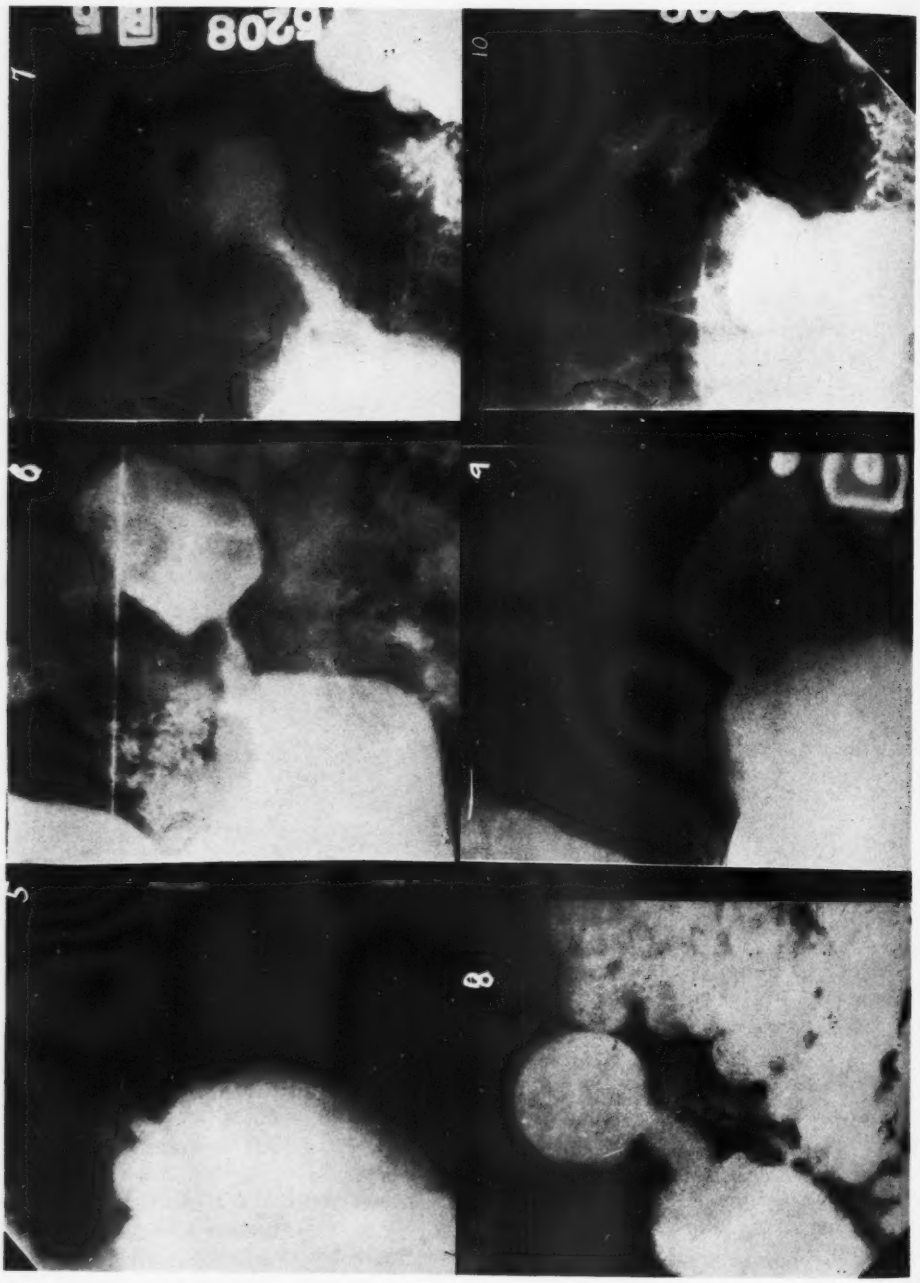


Fig. 2. Cases 5, 6, 7, 8, 9, and 10.

formidable array, and challenge to greater effort in differential diagnosis. Needless to say here, and to you, that the 90 out of a 100 cases in which an interpretation is correct fail to outweigh the criticism of only one in which you were not letter-perfect.

Subject.—My subject is more in the form of a question, resulting from certain

radiologic observations in a series of pathologically proven cases, rather than a criticism of any present methods or the presentation of anything startling or new.

Basis.—As a basis for our investigation, we have reviewed our files and follow-up records in approximately 5,000 roentgen gastric examinations, of which almost 8 per cent were reported as showing definite intrinsic lesions. Of these, we have selected 100 consecutive cases of lesions at or near the pylorus in which either a follow-up through operation, or a pathologic study by biopsy or autopsy was obtainable. This means a successful follow-up in about 25 per cent of the cases.

In the remaining 300 cases, the operative data without biopsy but inclusive of the clinical follow-up would appear sufficient verification of the radiologic conclusions. These would have a definite bearing upon any statistical summation but should not be included where strict pathologic data are required.

Discussion.—In recent years, perhaps because of the apparent greater certitude thereby afforded, and because of the general interest given the subject by many publications, the direct method of visualization of gastric lesions and demonstration of mucous membrane defects appears to have taken precedent over the study of gastric functional disturbance, or the so-called symptom-complex method of interpretation, so ably employed by the early workers in this field.

There is no gain saying the fact that a film record showing a so-called characteristic defect affords most convincing evidence of a lesion. It is also apparent that some of the newer methods are but revivals or modifications of the morphologic and rugæ studies as previously accomplished with sedimentation mixtures, pastes, etc., wherein there is much redescription of mucuous membrane dimpling, distortion, and obliteration, along with the renaming of the Haudek niche of old.

It is not my intent in the least to detract from the value of the direct method of interpretation, since such study when followed by operation and biopsy supplies most valuable information as to the type, origin, and extent of any given lesion. On the other hand, it is well for the roentgenologist to keep in mind that at the present stage of the development of roentgenology there is as yet no direct means to radiologically determine color, consistency, cell types, or organisms, and, therefore, any attempted histologic interpretation is but a surmise based upon gross appearance and statistical average.

Again, the early carcinoma and the several other types of neoplastic disease, such as the small malignant ulcer, the granulating, florid, flat, shallow ulcers, and certain hemorrhagic cases, still offer interpretative difficulties to any radiologic procedure. In many of the cases of partial obstruction, the secondary changes tend to obscure the primary cause of the lesion and render direct visualization difficult. It is in such cases as these that the roentgen study of gastric dysfunction appears to us of paramount importance and affords much supportive information in the more difficult realm of differential diagnosis.

The more important and closely interrelated indirect roentgen data would appear to be as follows:

(1) Transitional changes in size, shape, position, and mobility of the stomach in reference to age, sex, and status.

(2) Gastric tonus, antral and pyloric action.

(3) Peristaltic activity, that is, the origin, depth, frequency, and asymmetry of action, as well as contractions and spasm.

(4) Evacuation and motility.

(5) Abnormal stasis, retention, and hypersecretion.

(6) Rugæ variations—organic or not.

(7) Morphologic defects, differentiating artifacts spasm, and those of extrinsic origin.

It might be well for us here to observe that not one of these data can stand alone, no more than any single symptomatic observation at the bedside is absolutely

TABLE I.—IMPORTANT ROENTGEN DATA OBSERVED IN 100 CONSECUTIVE OPERATIVE CASES OF PYLORIC LESIONS[1]

Pathologic diagnosis	No. cases	Shape	Size	Tone	Peristalsis	Retention	Motility	Defect	
Stenosing post-pyloric ulcer	31	Tendency hypertonic	Average normal	Active	Hyperactive	Medium large	Tendency hyper.	Niche Imperfection	14 17
Stenosing pre-pyloric ulcer	9	Hypotonic	Large	Poor	Periodically active and quiesent	Large crescentic	Hypo.	Niche Tapering	2 7
Papilloma and/or memb. hypertrophy	3	Average normal	Medium	Active	Fair	Medium	Average normal	Gap defect	3
Syphilitic infiltration	1	Hypertonic	Medium small	Active	Fair	Medium small	Hyper.	Annular constriction	
Tuberculous infiltration	1	Orthotonic	Average normal	Active	Fair	Medium small	Hyper.	Annular constriction	
Adhesions: bands	5	Average normal	Average normal	Active	Average normal	Medium small	Normal to hypo.	Variable constriction	5
Adenocarcinoma	32	Ortho. to hypertonic	Medium small	(Rigid)	Diminished to *absent*	Medium oval	Tendency hyper.	Nodular defect Constriction	29 3
Scirrhous carcinoma	11	Tendency hypertonic	Medium *small*	(Contract)	Diminished to *absent*	Small linear	Tendency hyper.	Rigidity and constriction	11
Malignant ulcer	4	Hypertonic	Medium	Active	Diminished	Medium oval	Normal to hypo.	Niche Tapering	3 1
Sarcoma	2	Hypertonic	Small	Active	Diminished	Medium small streak	Hypo.	Nodular Niches	1 1
Lymphoblastoma	1	Orthotonic	Medium	Active	Absent	Medium	Hyper.	Nodular defect	

[1] In this table, the cases have been grouped according to the pathologic findings with a summary of the essential functional aberrations observed.
It should be noted that this table represents but one-fourth of the total number wherein radiologic interpretation appeared conclusive. However, cases with insufficient micro-pathologic confirmation are not here listed.

characteristic. It is by the study and correlation of the symptom-complex as a whole that the true character of a given pathologic process may be revealed.

A statistical survey of our work would suggest that, if we adhere strictly to the operative cases with biopsy-autopsy confirmation, then we gain the impression that fully 50 per cent of all pyloric lesions are of a malignant nature. This, however, is due to the greater frequency with which operative procedure is instituted in the more serious cases.

If, on the other hand, all of the cases of pyloric pathology, radiologically determined (almost 400 in number covered by this period of investigation), are included, then only 25 per cent are recorded as malignant. In these there has been a sufficient time lapse with clinical follow-up or operation to justify this conclusion.

It is also evident that radiation therapy is not receiving proper consideration. I am convinced from experience that some of these patients would still be alive if proper radiation therapy had been used either pre- or post-operatively or without any operation (other than biopsy confirmation). These include at least the cases of congenital embryonal tumors, the lymphoblastomas (Hodgkin's disease), and lymphosarcomas.

SUMMARY

In summarizing, the following conclusions would appear justifiable:

1. The benign irritative lesion is responsible for a train of symptoms, such as: (*a*) hypertonus; (*b*) hypersecretion; (*c*) peristaltic hyperactivity, and (*d*) spasm, with (*e*) resultant disturbance in motility.

2. In the benign pyloric obstructive lesion the complex is most impressive. The observed data are as follows: (*a*) delayed evacuation with marked hypomotility and pronounced gastric retention; (*b*) atony and dilatation (from gastric wall atrophy); (*c*) long periods of quiescence, alternating with periodic peristaltic hyperactivity. (The primary cause most frequently is callous ulcer.)

3. Again, how clearly the partial postpyloric obstructive lesion can be defined if one will but observe that (*a*) with gastric hypertrophy the tonus is preserved, if not exaggerated; (*b*) the peristaltic hyperactivity is especially prominent in the pylorus with antral distention; (*c*) notwithstanding a fair sized gastric residue continuing well beyond the normal time limit a colonic hypermotility frequently exists.

Truly it must be apparent that by the observance of such symptomatology a differentiation between the benign pre- and post-pyloric lesions can well be established. One not infrequently meets a lesion wherein the morphologic study leaves one in doubt as to its benign or malignant character. Here again will the observance of the indirect data often afford the necessary information for differentiation.

4. Faced with a lesion in an obstructive location the following are convincing observations of the malignant character of the process: (*a*) the gastric shrinkage; *i.e.*, the luminal contraction; (*b*) the wall rigidity; (*c*) the lack of peristaltic activity over the infiltrative area; (*d*) the patency with (*f*) a paradoxical hypermotility.

5. When with the usual contrast meal a definite morphologic defect is discernible, then may a systematic functional study aid in determining the degree of irritation, obstruction, or disturbed motility caused by the lesion, as well as afford greater refinement in differential diagnosis.

A detail rugæ study would, under these conditions, appear superfluous since, frankly, most of the reproductions of rugæ defects are only corroborative of previously suspected or morphologically proven lesions.

6. When functional disturbances of undetermined origin are observed wherein the causative factor is morphologically not revealed but the stomach is none the less under suspicion, then the greater detail afforded by the rugæ study would justify the additional time, energy, and expense of this procedure. On the other hand, it is also well to remember that every gastric

upset is not necessarily indicative of ulcer, carcinoma, or other serious organic diseases.

Acknowledgment is hereby made of my indebtedness to all the associates in the Department of Roentgenology for their assistance in compiling the data. Special mention to Dr. Debbie, Dr. Furst, and Dr. Kurtz, for their perseverance in obtaining follow-up data, and to Dr. Schlein for his diligence in compiling and tabulating the cases.

THE SOCIAL AND ECONOMIC ASPECTS OF CANCER[1]

By ALBERT SOILAND, M.D., D.M.R.E. (Camb.), *Los Angeles, California*

LOOKING at the cancer problem in America, from both an economic and a social viewpoint, based on intimate contact with patients for over a quarter of a century, I am convinced that a determined effort at mass education is necessary if we are ever to gain the upper hand of this dread disease. By mass education I mean a serious attempt to arouse public interest, not by intimidation or force of arms, but by an earnest appeal to reason—establishing an intelligent and sympathetic understanding to which every interested individual may subscribe and work in a spirit of united harmony.

Before undertaking any comprehensive public campaign, the medical profession itself should become more cancer-minded. It is true that in the larger medical centers an increasingly greater number of surgeons, radiologists, pathologists, and other cancer students are working consistently and faithfully to this end, but a surprisingly large majority among the members of the regular medical profession seems either apathetic or but casually interested. Unless this latter group can be aroused, our task with the public will be rendered doubly difficult.

The general practitioner or the family physician is often too prone to advise his patient to ignore certain pathologic conditions of the skin, such as warts, moles, papillomas, or other irregularities, because they are symptomless. This is nothing more nor less than pure carelessness, and is usually due to the fact that the physician has not become cancer-minded, thus permitting many a potential cancer case to rest secure in this ill advice until the little lesion referred to has become fixed, or metastasized, or even hopeless.

It is not that this physician is unfamiliar with cancer, but the subject has not been sufficiently stressed for him to realize just how important his position is, for he stands in the first line of defense and offense against the insidious enemy, cancer. This general practitioner or family doctor should be contacted through his local medical societies and made thoroughly aware of his own important position and function in our world-wide cancer program. He should be made to realize that at the present time practically 10 per cent of the American population dies from cancer—an appalling increase during the past three decades; and also that this death rate can be materially reduced by an intelligent co-ordination of the knowledge now available.

It is singularly strange that our own nation, the United States of America, has failed to appreciate the social and economic phases of the cancer problem. We surely spend enormous sums to combat hog cholera, tuberculous cattle, infected poultry, and mangy dogs, but not one governmental penny to prevent a human being dying from cancer.

Let us briefly glance through and epitomize what twenty-seven foreign nations are doing at the present moment to fight humanity's most relentless enemy. This symposium was held under the auspices of the Fourth International Congress of Radiology at Zurich, Switzerland, the last week of July, 1934. The meeting took place in the Stadteater and was open to the public under the heading "Organized to Fight Cancer," and in the following order of nations.

Sweden (Prof. Gösta Forssell).—The fight against cancer is under government control. King Gustav donated 5,000,000 kroner for the purchase of radium after public-spirited citizens had established a radium home for the treatment of cancer. In that country, co-operation between the government and the medical profession has

[1] Presented before The Oklahoma City Clinical Conference, Nov. 1, 1934.

demonstrated its value to the point that Sweden ranks perhaps first among the world's nations where cancer is practically under an intelligent control.

Egypt (Dr. M. A. Afifi).—Here cancer is considered as part of the general health problem of the land, and the government is assisting in equipping suitable hospitals with x-ray and radium facilities. Due to the thorough religious cleanliness of the Mohammedan race, which constitutes a large part of Egypt's population, the death rate from cancer is considerably lower than in more industrialized nations.

United States of America (Dr. Albert Soiland).—The government has so far taken no official steps to combat cancer. Several state medical associations have cancer commissions. A number of surgical and medical bodies have cancer committees and many of the larger hospitals have cancer clinics. There is an endowed American Society for the Control of Cancer, and a number of universities have cancer research departments. Much experimental work is under way with super-high voltage x-ray apparatus, the first one emanating from the California Institute of Technology in 1928, under the direction of Professor R. A. Millikan and Dr. Charles C. Lauritsen.

Austria (Prof. G. Schwarz).—In 1911 was founded the Austrian Society for the Investigation and Treatment of Cancer, and is to-day the central organization in the campaign against cancer. Rather meager funds are obtained from private sources. The Society sends out information to the profession and also advises the laity to seek diagnosis and treatment from physicians and not quacks. Cancer treatment is given at university clinics, and large general hospitals, by staff specialists. The Vienna General Hospital, founded in 1912, has over a gram of radium, provided by public funds. In 1930 a new radium institute was founded in Vienna and provided with five grams of radium.

Dr. H. M. Moran makes a plea for a more frequent and intelligent use of radiation therapy in cancer. He summarizes his suggestions for cancer control under the following heads: Prophylaxis; post-graduate medical education; coordination of treatment and, in particular, the limitation of the right to employ radiotherapy to those trained and qualified to use it; and, finally, a more extensive and more friendly cooperation between the surgeon and the radiologist.

Belgium (Prof. Joseph Maisin).—Has a national cancer commission appointed by the government, which consists of specialists in cancerology. It controls the subsidies granted to the various cancer-treating organizations. There are four cancer-treatment centers supported by the government, where an abundant supply of radium is available. Like Sweden, Belgium has an enviable position and is well "organized to fight cancer."

Denmark (Dr. Jens Juul).—Has no special cancer hospitals. The government contributes a little money; insurance companies and private individuals more. There are three cancer centers where radium is available and the surgeon and radiologist have charge of the work. Denmark is making good progress in the cancer campaign.

Germany (Dr. Kurt Weiss).—After intermittent attempts to organize a cancer commission in 1910, a new committee was formed in 1930 to organize measures for the fight against cancer as a disease of the people. The committee is subsidized by the constituent states of the Reich. There are eight German centers for the diagnosis and care of cancer patients.

France (Dr. R. Ledoux-Lebard).—This country was early to recognize the necessity for cancer study and control. Like Sweden and Belgium, it recognized the necessity of studying the social side of the problem as well as the economic, since the incidence of cancer in France is well marked. There are a number of well organized and equipped leagues, institutions, and hospital groups where the highest type of surgical and radiological treatment is available. Dr. Ledoux-Lebard feels that his country is incomparably complete in its fight against cancer.

Greece (Dr. A. Lambadaridès).—Finan-

cial and economic difficulties have made it very hard for Greece to take on an active anti-cancer campaign. Private parties purchased a little radium for the medical profession. The foundation of a cancer institute is the most important problem facing students of cancerology to-day.

Great Britain (Dr. A. B. Smallman).—The best cancer statistics during the past thirty years come from England, where Dr. Smallman has presented some very interesting diagnostic figures. It appears that the death rate among males is increasing greatly over that of females during the years mentioned, which this author feels has occurred despite more accurate diagnostic facilities, thus showing that cancer incidence is increasing. He finds that the mortality is falling off in cases in which cancer occurs in organs so accessible and localized that they are amenable to modern treatment. He urges a thorough study of cancer on an organic classification and makes a plea for a grouping of large numbers of individual cases for this purpose. This calls for a centralization and co-ordination of clinical statistical studies of cancer incidence.

Ireland (Dr. Oliver Chance).—Here the cancer fight is just beginning. Tuberculosis has been a big problem but is now under control, so the medical authorities are turning to the cancer problem. Radium emanation is available at a nominal charge, and education among the Irish people is carried on through the general medical profession.

Italy (Prof. G. G. Palmieri).—In 1922 Italy began to fight cancer in earnest with the foundation of the Italian Anti-Cancer Federation, and in 1929 the Cancer Institute Victor Emanuel III was inaugurated. For a number of years, however, the national Fascist government has supplied financial help, and a large institute was founded in Rome. At the present time there are a number of important cancer research and treatment centers, the social side of which are being actively developed by the government. The country has nine grams of radium and all institutions are equipped with short wave x-ray equipment.

Japan (Prof. T. Watanabe).—This country has a foundation for cancer research, established in 1907, to stimulate interest and furnish funds for students interested in cancerology. A large institute in Tokio is devoted to the clinical and laboratory investigation of cancer. A council of the Cancer Foundation is disseminating knowledge and carrying on active propaganda throughout all Japan, and the medical personnel of the Foundation believes Japan will soon become cancer-minded.

Jugoslavia (Dr. S. Tassovatz).—The Jugoslavian Society for Cancer was founded in 1927, and is active in cancer research and treatment. There are no special cancer institutes but the medical profession is carrying on cancer education among the laity. Belgrade and Zagreb are the only two towns with radium. The Jugoslavian Society is immediately concerned with the creation of a cancer institute where research and treatment can be prosecuted.

New Zealand (Dr. Charles F. De Monchaux).—The British Empire Cancer Campaign Society has a branch in New Zealand. Funds were raised by public subscription and netted £70,000. There are four central divisions where cancer work is institutionalized. Weekly clinics are held, headed by two surgeons, one pathologist, and two radiologists, other specialists being called in for consultation when necessary. Radium is employed, limited strictly to those who are qualified by training and experience to use it. The work of the four divisions is registered and tabulated by a central special official. Cancer education to practitioners and students emanates from the centers. The Society itself maintains facilities for research in cancerology. It has available a special travelling radio-physicist who standardizes all radiation equipment.

Netherlands (Dr. Daniel den Hoed).—In Holland the cancer campaign is limited to a study of the disease and the education of the public, as the treatment of patients is not centralized. There is a private cancer clinic in Amsterdam supported by the

medical profession and private individuals, to which the government also subscribes. This is a modern institution, fully equipped. Research work is carried out, volunteers are trained in cancerology, and prizes are awarded for meritorious work.

Norway (Prof. S. A. Heyerdahl).—The Norwegian Medical Association studied 25,000 deaths from cancer, and came to the conclusion that a certain family liability or heredity was a basic factor. This work began in 1907. In 1919 the government advanced 1,000,000 kroner for a national cancer hospital, which had been suggested by the Central Committee of the Medical Association. Thus, the Norwegian Radium Hospital was opened in 1932. It is quite complete with all modern appliances, and has three grams of radium. Its director is a radiologist.

Persia (Dr. Mohammad Khan Hessaby).—The country recently organized an anti-cancer campaign supported by His Majesty Reza Schah Pehlevi, who yearly donates a respectable sum. A central radiological institute has been established, furnished with all modern apparatus except radium, which will soon be added.

Poland (Dr. Zygmunt Stankiewicz).—The Polish Anti-cancer Campaign Committee was founded in 1921, although intermittent studies had been under way since 1906. The anti-cancer center is in Warsaw and its efforts are directed toward securing funds for a radium institute, as its present amount of radium is inadequate. New centers are in the process of completion at Lodz, Poznan, Vilno, and Lwow. Propaganda is active both among the profession and laity, and these activities are developing rapidly.

Portugal (Prof. Mark Athias).—In 1927 the Portuguese Institute for Cancer Research came into being. It is attached to the University in Lisbon and supported financially by the state, the insurance societies, and the medical faculty. There are three departments—x-ray, radium, and a clinical division. Indigents are treated free of charge. The work is being publicized and attempts are under way to equip similar institutes in the other university cities.

Russia (Prof. G. O. Charmandarjan).—The Peoples Commissary for Russian Health Affairs, among other duties, directs the cancer campaign. The system appears somewhat complicated, but plans contemplate a scientific investigation of the cancer problem with education of specialists and teachers. It is aimed to found hospitals, create post-graduate courses, where diagnosis and statistics of cancer may be arranged and where care may be taken of incurable cases.

Switzerland (Prof. Alfred Rosselet).—The Swiss National League against Cancer became active in 1910 under the direction of the Health Department, its first object being to support scientific research and organize meetings for public education. It is now attempting to co-ordinate the various centers. The government is unable to provide for a central organization, so each state arranges its own cancer work. The various regional hospitals and university clinics take care of cancer patients. Private funds are sought for the purchase of radium.

Spain (Prof. Carlos Gil Gil).—In 1919 the National Anti-cancer Society was founded. The Anti-cancer League was formed in 1923 with support from the state, which is now carrying on a systematic program so that all parts of Spain may enjoy the same facilities for the treatment of cancer patients. Madrid is the center, with its National Cancer Institute fully equipped with all modern weapons to fight cancer. Besides, there are six large cities with regional centers co-operating with one another under the direction of the health authorities. There are also a number of secondary centers which provide a link between the regional centers and the general practitioners.

Tartar Republic (Prof. Ruben Gassul).—To the Cancer Institute already established come many patients for treatment in a very advanced state. Cancer departments have been established in all clinics, where consultation is available. Propaganda is under way and statistics are being compiled.

Tchekoslovakia (Dr. Anton Ostrčil).—This country's Society against Cancer was founded in 1904 with the following program: (1) Scientific study of cancer; (2) early diagnosis; (3) treatment; (4) public instruction. The most important institute is in Prague. Four or five others are being modernized. This little country has already twenty-four grams of radium in use and is adding three grams yearly.

Hungary (Dr. Ivan Von Büben).—During recent years the death rate from cancer has definitely increased. Systematic fighting against cancer began in 1900, with the Cancer Commission of the Royal Medical Association compiling cancer statistics. The Great War stifled cancer research but now it is being prosecuted with greater vigor. The general hospitals and allied institutes are doing cancer research and treatment, and the Cancer Commission is co-ordinating this work.

In summing up the cancer program of these twenty-seven progressive nations, it is significant to note that they are all engaged in practically the same line of endeavor. This is quite in harmony with the viewpoints of advanced American cancer students and resembles our own conception of proper progress. If a commission of representative medical men will establish a central bureau, America would acquire a leading position in this necessary world's undertaking. If I may be permitted to suggest a supervisional system, it would be something like the following:

1. Organize a central bureau of cancer study and research.
2. Establish cancer branches in all accredited universities, hospitals, and clinics where adequate facilities for such work exist.
3. Permit no one not qualified by training and experience to use radium or x-rays for the treatment of cancer, and then only after consultation with specified authorities.
4. Sell or rent radium only to such experienced operators as noted under paragraph 3.
5. Allow no surgical operation for cancer unless approved by specified authorities after consultation.
6. Every potential cancer patient should have the benefit of a complete clinical examination and consultation between internist, surgeon, and radiologist, and pathologist before treatment is instituted.
7. Copies of the records of every cancer patient should be sent to the central bureau for compilation and that statistical progress may be noted.
8. Such a régime would, before very long, do away with cancer exploitation and abuse, and place America in the first rank of nations "organized to fight cancer."

CHOLECYSTOGRAPHIC DIAGNOSIS: MANAGEMENT AND TECHNIC FOR ORAL CHOLECYSTOGRAPHY[1]

By D. S. BEILIN, M.D., Radiologist, Augustana Hospital, *Chicago*

THE management and technic for oral cholecystography must be well standardized for uniform results, particularly when there are a number of assistants conducting the cholecystographic examinations.

The patients are informed explicitly in regard to the nature and routine of the examination, a simple account being given them of its management from beginning to end. After the patient is completely disrobed and attired in a gown which has no buttons, metal fasteners, etc., a preliminary roentgenogram of the gall-bladder region is made to determine the following: whether or not the gall-bladder shadow is visible; the size and position of the right lobe of the liver; the eliciting of opaque calculi if present; the determination of the extent of gas and fecal material within the colon, as well as the location of the hepatic flexure.

The patient is placed prone on the radiographic table which contains a Bucky diaphragm so placed that the right upper quadrant of the patient is at its center, in order that the central rays of the x-ray tube shall pass through the right upper quadrant. Size 10 by 12 cassettes are used and placed so that a portion of the crest of the ilium is visualized on the lower border of the roentgenogram. In the majority of individuals a film of this size will include the gall-bladder area and the right lobe of the liver, down to the crest of the ilium.

If the preliminary roentgenogram reveals a considerable amount of gas and fecal material within the colon, and if there is no contra-indication to a laxative, the patient is instructed to take from one to one and one-half tablespoonful of compound licorice powder at 3:00 P.M. the day prior to the Graham examination. If a laxative is contra-indicated, the patient is instructed to take an enema on the evening before the examination as well as at 7:00 A.M. on the morning of the roentgen examination. On the preceding evening, the patient is given a prescribed supper at 6:00 P.M. which consists of toast or crackers, baked or boiled potato, raw or cooked fruit, tea or coffee; no fats are given. At 8:00 P.M. the patient drinks a single dose of the sodium salt tetraiodophenolphthalein which is usually four grams, and in some instances five grams, depending upon the anteroposterior diameter of the abdomen as well as the patient's weight. The patient may have water at frequent intervals and is instructed to have no breakfast whatever.

At 9:00 A.M. the following morning, the first or thirteen-hour roentgenogram is made. If the gall bladder is obscured by gas or fecal material, the patient is given an enema. At 11:00 A.M. the fifteen-hour films are made, which include roentgenograms in both the postero-anterior and anteroposterior views. If the gall-bladder shadow is distinctly visualized, and if up to this point the examination is satisfactory, the patient is allowed to eat a meal rich in proteins and fats. At one hour after this meal the patient is requested to return for the seventeen-hour roentgenogram. If, however, the gall-bladder shadow is not distinctly visualized at fifteen hours, the patient may be requested to return at seventeen, nineteen, and not infrequently twenty-one hours without food, in order to study the filling and concentration of the gall bladder and more particularly to conclusively exclude faintly defined radiotranslucent calculi. In certain cases, roentgenograms of the gall bladder are made in the upright position, in the oblique and lateral views, and only occasionally with compression.

The meal which is usually given after the fifteen-hour examination consists of dry or cooked cereal with cream, bacon and eggs,

[1] Presented at the clinic of the Radiological Society of North America, at the Twentieth Annual Meeting, in Memphis, Tenn., Dec. 3–7, 1934.

two pieces of toast with four squares of butter, and a glass of half milk and half cream.

In some cases of the non-visualized gall bladder, the examination is repeated, particularly when the roentgen findings do not fit into the clinical picture and when there has been some error on the part of the patient in following out the instruction.

There are many radiographic technics for the gall-bladder examination, and the end-result in one may be as good as in the other. The technic may often depend upon the capacity of the equipment that one has at his disposal. As a routine it has been found that the best roentgenograms are obtained when the voltage is kept as low as possible. This depends upon the ability and the condition of the patient to co-operate, and not infrequently the voltage factor will have to be increased in order to maintain an exposure time as short as possible.

The x-ray diagnosis of a pathologic gall bladder is dependable up to about 98 per cent; the roentgen diagnosis of a normal gall bladder is dependable up to about 95 per cent in cases in which the management and technics are exacting. However, in some cases the normal cholecystogram is prone to error. It is important, therefore, in certain patients who have a normal cholecystogram to regard these criteria as an adjunct only in the clinical examination and of value only when interpreted in conjunction with the clinical history and physical findings and after all known extra-cystic factors have been excluded.

It is well known that a small percentage of patients having a pathologic gall bladder will reveal a normal cholecystographic series. In order to avoid clinical error in this group of cases, the normal cholecystographic findings should be evaluated with the clinical history and physical findings, and can be relied upon only when other extra-cystic factors have been excluded, and when the extra-cystic findings account for the symptomatology. Otherwise, a patient with a normal cholecystographic series, in whom other abdominal conditions have been excluded, should be considered to have a pathologic gall bladder if the clinical findings are indicative of such, regardless of the normal cholecystographic series.

The following conditions have been found to be the cause of non-visualization of the gall bladder: hepatitis; cholangitis; duodenal ulcer; achlorhydria; malignancy of the stomach, liver, and pancreas. One must also bear in mind the rare possibility of congenital absence of the gall bladder as well as transposition of the abdominal viscera, in which case the gall bladder would be in the upper left quadrant. It is readily to be seen that errors in cholecystographic interpretation can be reduced to a minimum in conjunction with an examination of the gastro-intestinal tract.

As clinicians practising radiology, we must pay some attention to the differential diagnosis of gall-bladder disease. The following conditions should be considered: duodenal and pyloric ulcer; duodenal stasis; duodenitis; hypo-acidity; visceroptosis; enlargement of the liver due to passive congestive in decompensated rheumatic heart; diaphragmatic pleurisy; subdiaphragmatic abscess; hepatic abscess; hydatid cysts of the liver; tertiary syphilis of the liver; pathologic appendix; incomplete intestinal obstruction; carcinoma of

TABLE I.—TECHNICAL FACTORS USED IN CHOLECYSTOGRAPHY

Cm. (A.P.) thickness	Pos.	Time	A.T. volts	K.V.	Ma.	Dist.	Tube	Fast screen	Bucky	Cone
15	P.A.	1.5	117	52	100	27	100	Yes	Yes	Yes
20	P.A.	2.5	117	52	100	27	100	Yes	Yes	Yes
25	P.A.	3	122	56	100	27	100	Yes	Yes	Yes
25	Lat.	3	137	68	100	27	100	Yes	Yes	Yes

the stomach; carcinoma of the bile ducts; carcinoma of the pancreas; hydronephrosis; pyonephrosis; renal calculi, etc.

If the foregoing principles and methods are carried out, we, as clinicians practising radiology, will find that the errors in cholecystographic diagnoses will be reduced to a minimum.

X-RAY STUDY OF THE GASTRIC RUGAE

By WALTER E. PENNINGTON, M.D., *Indianapolis, Indiana*

WHILE the above subject has been treated and described by numerous men since 1912, yet a review of the literature on this subject shows that each student was confronted with troubles in technic. A great variety of methods have been described, including fluoroscopic studies; numerous types of gastric meals, such as barium suspensions; colloidal solutions; oil suspensions of opaque media, and double contrast methods by means of air or carbon dioxide.

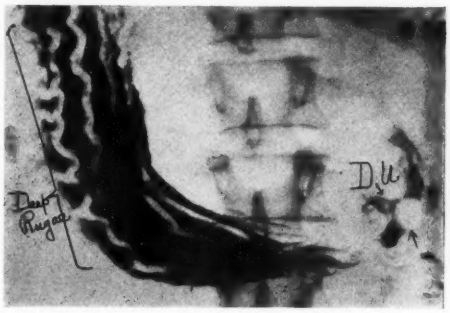


Fig. 3.

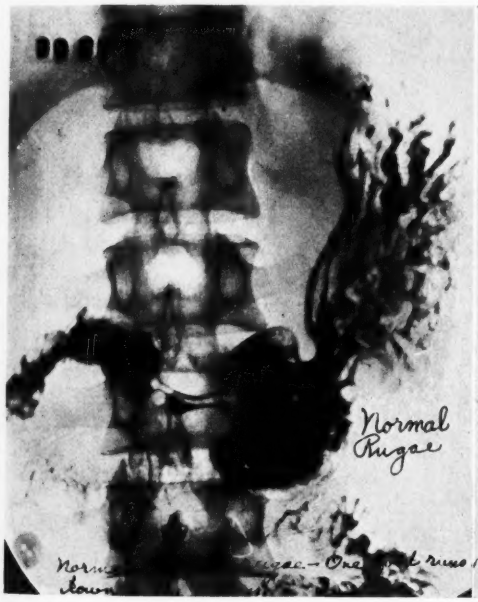


Fig. 1.

Fig. 2.

The greatest handicap seemed to be in getting a proper suspension of the barium and then getting rapid films so as to eliminate motion of the stomach peristalsis and motion from the aortic pulsation. The stomach wall must be studied with respect to the rugæ before the stomach has been distended or heavily palpated. Either of the latter procedures will have a tendency to iron out the mucosa folds.

It has been previously demonstrated that the mucous membrane has a distinctive movement of its own: action of the muscularis mucosæ. Usually after the stomach has been at rest the observer will expect to find normal mucosa folds in a normal

Fig. 4.

Fig. 5.

stomach. However, in some atrophic conditions the folds may be absent.

Scirrhous infiltration of the stomach wall has a tendency to destroy the muscular action and iron out the mucous membrane. The condition described as linitis plastica also thickens the stomach wall and makes it sufficiently rigid to obscure the mucosa folds. Polypoid growths attached to the stomach wall also destroy normal folds. Ulceration without gastric muscular infiltration will destroy the folds in the immediate vicinity of the ulcer; however, normal folds may be traced down to the ulcerative area and may be observed immediately distal to the ulcerative zone.

There is no intention in this paper to minimize any method that has been used such as different postures, palpation of the stomach wall, the amount of the stomach meal, and thorough fluoroscopic examinations.

The most essential procedure in outlining the gastric rugæ is to get a proper barium suspension, using as little barium as possible suspended in a mucilaginous medium. This barium suspension must be of such a character that no precipitation will occur. The quantity of the meal must be the smallest amount which will outline the mucosa folds. The quantity of barium in the suspension must not make the meal sufficiently dense to prevent energizing the film through the column of barium. Obviously, the quantity would vary with different patients.

Different types of folds have been described. The longitudinal folds, which run from cardia to pylorus, may be called the primary type. There is also a slightly transverse fold which is the result of extra deep longitudinal folds with subsequent transverse pleats due to an excessive amount of mucosa lining. Another peculiar irregular fold occurs along the greater curvature which seems to be the result of fine peristaltic movements in the gastric wall.

Most of the information is obtained from the more constant folds of the longitudinal type. The so-called transverse folds and those along the greater curvature are more variable in their appearance. It is not

Fig. 6.

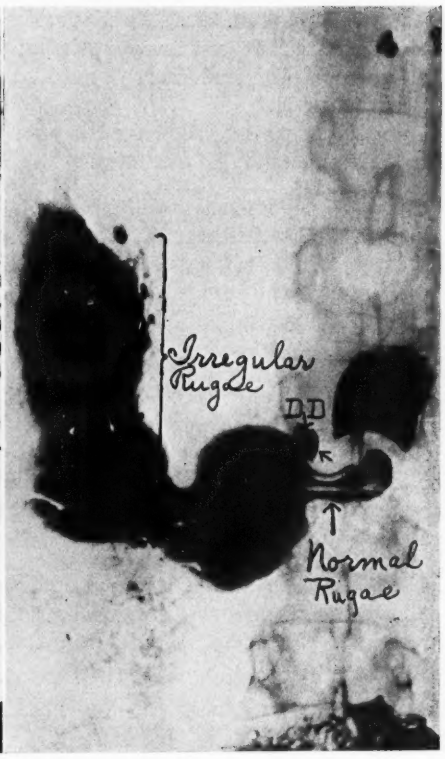


Fig. 7.

right to say that the folds are of an exact constant formation because they depend on the hypotonicity, hypertonicity, or orthotonicity of the stomach.

Visualized folds vary in their depth according to the quantity of barium used in the stomach, the degree of compression, and the amount of manipulation. However, if we do not exaggerate any of the above factors a constant general picture of the rugæ will be found in each normal patient.

Some of the following characteristics are to be observed when studying the mucosa folds:

Parallel rugæ running from cardia to pylorus; transverse folds which occur in excessive mucous membrane, with subsequent pleating of the longitudinal or parallel folds; irregular folds on the greater curvature which seem to be the result of finer peristaltic movements; stellate folds which seem to have a central scirrhous area; wide folds which may present light plateau areas or jigsaw puzzle effect; absence of folds.

An observation was made in a patient who was gradually failing because of pyloric obstruction and inability to handle food. The x-ray examination showed a small ulcer crater in the pylorus and a well-defined ulcer in the duodenal cap. Three consecutive stomach examinations showed a very spastic lower third of the stomach, with a constant contraction of the gastric lumen to the size of the thumb. At no time was there any relaxation of the gastric wall. On account of the rigidity of the gastric wall and diminished peristalsis it was thought that a possible carcinoma existed. Diagnosis was made of ulcer of the duodenum and pylorus, with possible infiltration of the lower third of the stomach. Operation showed only the duodenal and pyloric ulcers. A review of the gastric films showed one, two, and three fine rugæ extending

down to the pylorus. Had these rugæ been noticed on the first examination, the tentative diagnosis of malignancy would not have been made.

In conclusion, the following characteristics of the rugæ may be evaluated:

Carcinoma.—The rugæ will be distinctly ironed out in the infiltrated area. Some of the longitudinal folds may circle the scirrhous zone or they may be completely effaced, to begin again on the opposite side of the growth.

Hypertrophic Gastritis.—The rugæ become very wide and sometimes may not be identified as such. One stomach resembled the irregular lines of a jigsaw puzzle, with intervening plateau areas, with no evidence or resemblance of normal rugæ.

Polypoid Growths.—The rugæ act in a very similar manner to those described in carcinoma. The normal folds do not stop as abruptly as those shown when an ulcer is present.

Ulcer.—The rugæ may be destroyed in the area of the ulcer and may cut off sharp at the edge of the crater. It is not uncommon for them to also circle the ulcer area. The constant deformity of the rugæ folds is to be noted when an ulcer is present.

The study of the gastric rugæ is important. We must exercise patience in getting the stomach properly filled, using, first, a very small dose of barium and adding to it as necessary to properly outline the rugæ. A correct suspension of barium must be used. Films must be made with sufficient rapidity to eliminate the movements of peristalsis and aortic pulsation.

Normal rugæ indicate a normal stomach wall. Deformed rugæ are indices of pathology and will give information on early carcinoma, gastritis with plateau-shaped areas of inflammation, gastric polyps, and gastric ulcer.

A SIMPLE METHOD FOR DETERMINING THE DEGREE OF INSPIRATION FROM THE CHEST FILM[1]

By KENNETH D. A. ALLEN, M.D., *and* HAROLD D. WALTZ, M.D., with the Technical Assistance of DOROTHY D. HANNER, *Denver*

From the Child Research Council and the University of Colorado School of Medicine

INTRODUCTION

A REVIEW of the available American and some foreign literature has failed to disclose a reference to a method of determining, from the roentgenogram itself, the degree of inspiration at which a radiograph of a chest is made. An x-ray examination of a co-operative patient assures a known phase of respiration if the proper radiographic technic is used. However, in younger children and unco-operative adults, the phase of respiration must be determined from the plates.

It is the purpose of this paper to show that a knowledge of the phase of respiration is vital to the interpretation of a radiograph of the lung-fields, especially in children: also, it is our intent to describe a very simple method by which it may be determined by certain measurements on the roentgenogram itself. Roentgenograms made of healthy chests, when the lungs are in a state of incomplete inspiration, may show departures from the x-ray manifestations of normal lung-fields as they appear during complete inspiration which are practically indistinguishable from pathologic changes.

Most of the x-ray evidence of pulmonary or cardiac disease, upon which diagnostic opinion is based, is composed of the following x-ray signs:

1. Degree of intensification of the trunk shadow;
2. Mediastinal and cardiac contour;
3. Outline of the thymus gland;
4. Size, shape, and density of the hilum shadows;
5. Degree of aëration of the lung parenchyma;
6. Presence or absence of parenchymal air displacement by infiltration or fibrosis;
7. Degree of visability, size, and shape of lymphoid elements;
8. Shape, position, and contour of the domes of the hemidiaphragms;
9. Position and spacing of the ribs;
10. Size, outline, and position of the trachea and main stem bronchi.

We will present evidence which indicates that practically all of these signs change to a greater or less degree with respiration. If these signs do change as does the phase of respiration, it seems futile to render an opinion on the condition of the lung-fields of an unco-operative child or adult unless the degree of inspiration during which the x-ray plate was exposed is positively known.

Evidence that respiration does alter these signs is furnished by Figure 1, which demonstrates the conspicuous diversity produced in the cases of three healthy co-operative children, by making plates at inspiration and at expiration in each case. These three children are clinically and radiographically (on other plates made at inspiration) free from any signs of pulmonary disease, and because of their co-operation we know the respiratory phase at which the plates are made. *A*, *b*, and *c* show complete expiration; *d*, *e*, and *f* are made at inspiration. Additional figures illustrating this article for other purposes, especially Figure 2, *a* and *c*, also show this same phenomenon. The factors of radiographic technic used for the plates made at inspiration are exactly the same as those which show the expiratory phase. The plates of both phases of respiration were made only a few minutes apart.

A comparative study of the plates representing the opposite phases of respiration discloses that all the signs listed above have been changed, at least in the degree of visi-

[1] Presented before the Radiological Society of North America, at the Twentieth Annual Meeting, in Memphis, Tenn., Dec. 3–7, 1934.

bility, during the patient's respiration. If the criteria which determine the normal or abnormal state vary with breathing, it be-

at inspiration. The changes in the x-ray signs of the normal lung at inspiration (*c*), effected by a reversal of respiratory phase

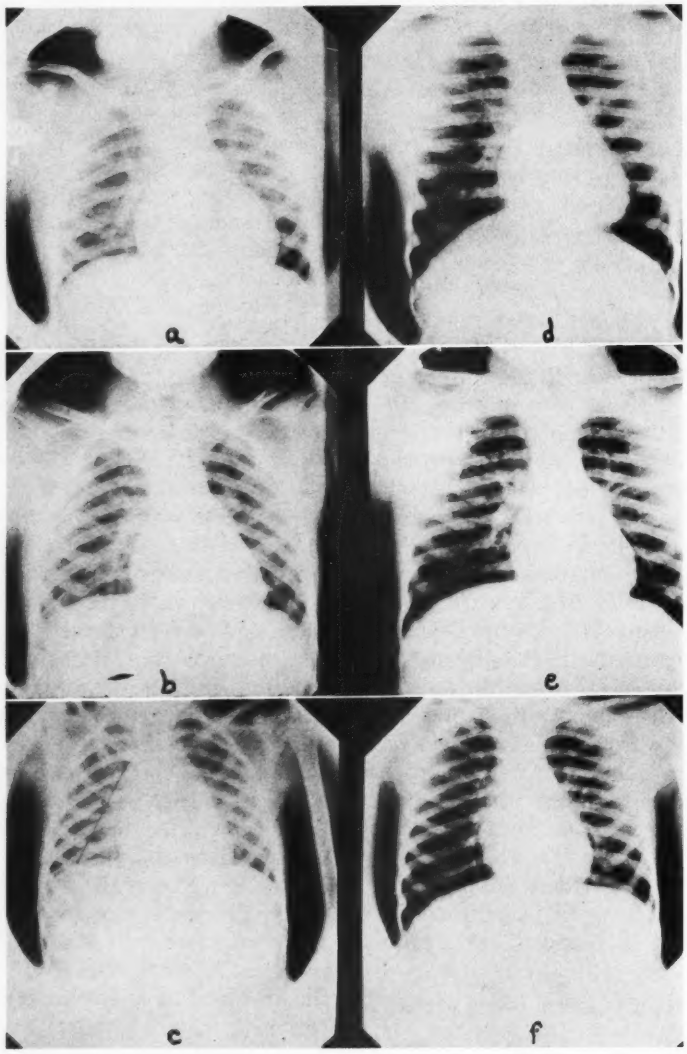


Fig. 1. Three normal children radiated at expiration (*a, b, c*) and inspiration (*d, e, f*) wtih duplicated technic. The diagnostic criteria change markedly with the phase of respiration.

comes obvious that, before an opinion can be rendered, the degree of inspiration must be known. Compare the plates (Fig. 2) representing inspiration (*c*) and expiration (*a*) of a healthy child with a case of known disease (*b*) in which the plates were made

(*a*), seem even greater than the changes produced in the pathologic case by bronchopneumonia (*b*). The variation in the x-ray signs brought about by inspiration and expiration in normal cases have been tabulated to facilitate comparison (See Table I).

A study of this table discloses the fundamental changes in the diagnostic x-ray signs (Fig. 2). As the lung-fields are depleted of air, these changes simulate disease. Since it is impossible to routinely obtain radiographs in a known phase of respiration in infants and unco-operative patients, it becomes necessary to learn the degree of inspiration from the roentgenogram. A roentgenologist is repeatedly confronted with a roentgenogram of the lung-fields made in only one phase of respiration, and that unknown. It cannot be denied that in such a predicament a means of eliciting the degree of inspiration from the plate will greatly enhance the accuracy of interpretation. Before describing the method of determining this, it is deemed advisable to briefly summarize the present status of the radiographic technic required for depicting the infant's chest.

X-ray Technic.—At this time there is no practical precision apparatus which automatically causes film exposure at complete inspiration. The only way this can be routinely attempted in unco-operative patients is through visual determination by the technician. Probably the best results are obtained when the operator assumes a position which places her eyes tangential to the anterior or posterior body wall of the patient, closing the primary switch when the abdominal diameters assume the greatest proportions (Fig. 3).

Figure 4 shows that one-half second or less is the limit of time during which an exposure of complete inspiration can be obtained. Also, Figure 4 demonstrates that there may be more air in the lungs at all phases of respiration during a crying spell than during quiet breathing. Therefore, more complete inspiration can be depicted on the plate if it is made during a crying spell.

In our laboratory a couch with the tube beneath the patient permits the infant to lie on its back (the usual choice) with the plate held to the anterior chest wall by a special frame (Fig. 3). The height of the table facilitates a tangential position of the technician's eyes. (When plates are made in the erect posture by the swaddling or strapping methods, the technician should assume a position in which she can still keep her eyes in a tangential relationship.) A further advantage is the shock-proof features which are combined with a machine of high power capacity. This permits long object-plate distance and still furnishes adequate density with a one-twentieth of a

TABLE I.—A COMPARISON OF CHANGES PRODUCED BY INSPIRATION AND EXPIRATION

	Inspiration	Expiration
Trunk shadows	Less intensified	More intensified
Mediastinum	Narrower and lower in chest	Broader and higher in chest
Thymic shadow	Narrower	Broader (may assume bizarre shape)
Hilum shadows	Longer and wider; less dense	Shorter and broader; more dense
Parenchyma	Increased aëration	Less aëration suggests parenchymal infiltrations
Lymphoid elements	Less visible	More visible
Diaphragm	Domes lower, irregular, and flatter Right dome generally higher than left	Domes higher, smoother, and more arched Right and left domes nearer same level
Carina	Lower	Higher
Trachea	Wider	Narrower
Heart	Lower and narrower; more perpendicular	Higher and wider More horizontal (may assume abnormal and bizarre shapes)
Ribs	Horizontal, apart	Slanting, approximated

second exposure, producing good detail and sufficient contrast to make the detail visible. We find even with this equipment[2] that it is difficult to obtain exposures at complete inspiration with any degree of certainty.

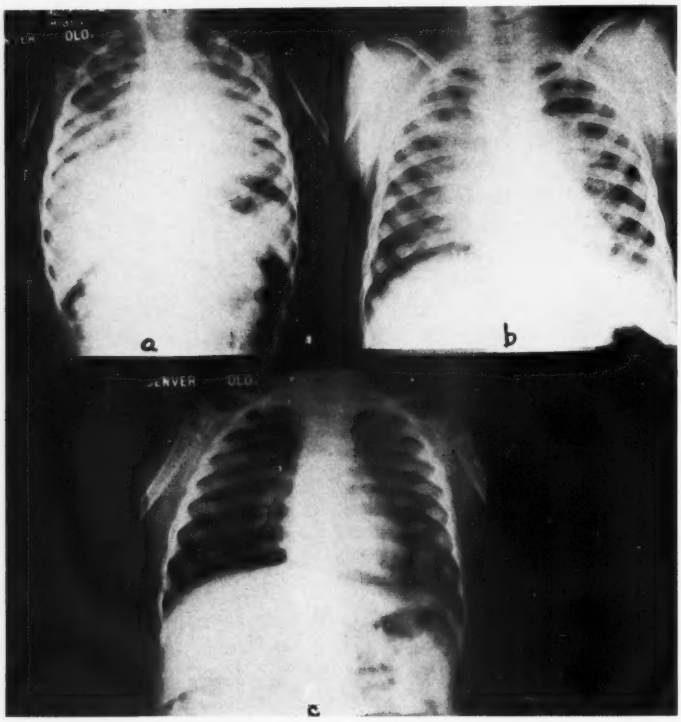


Fig. 2. Expiration in a healthy child (*a*) suggests more disease than a known case of bronchial pneumonia (*b*) unless the phase of respiration is determined. *C* is the same as *a* taken in inspiration a few minutes later.

AN X-RAY SIGN OF THE PHASE OF RESPIRATION

While seeking for a simple method of determining the phase of respiration from the x-ray plate, the following list of criteria was studied and applied to a large number of x-ray examinations of infants:

1. *The angulation of the ribs with the spine.*

This always approaches a right-angle at inspiration followed by some descent of the ribs at expiration.

2. *The angle made by the anterior with the posterior portion of a rib at the axillary border.*

This becomes more acute at inspiration but is found to be inconstant. Patients of different habitus show marked differences of this angle.

2. *The angle of the heart outline in relation to perpendicular.*

The heart changes to a more horizontal position with expiration, but because of wide variation of its position in relation to the habitus of an individual it was not found to be a reliable criterion of the degree of inspiration.

4. *The change in the position of the clavicles.*

The inner end of the clavicle rises markedly with inspiration, but this was found to be true only in the thoracic type of breathers.

5. *The position and contour of the diaphragmatic domes.*

[2] Installation by General Electric X-ray Corporation under Direction of W. Walter Wasson, M.D.

The height of the dome as compared to the spine is not a reliable sign of respiratory phase because in many cases its inner portion is its highest part, and the outer two-thirds only change with respiration. Furthermore in many cases in which serial x-ray examinations were made on the same co-operative child over a period of years at complete inspiration, it is noted that the level of the diaphragm descends as the patient grows older. The contour of the diaphragm is irregular at complete inspiration because at this phase it is tonic.

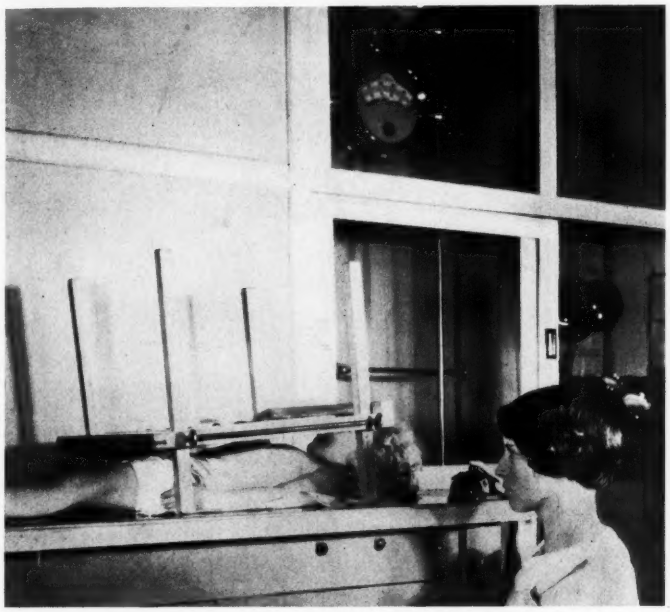


Fig. 3. No practical precision apparatus is available at this time for producing radiographs at complete inspiration in infants. The tangential position of the technician's eyes enhances the results.

6. *The magnitude of the cardio-phrenic and costo-phrenic angles.*

As the diaphragm descends and the dome flattens, the angle made by the profile of the diaphragm and the lateral chest wall obviously becomes more obtuse. No constant change is made in the cardio-phrenic angle by respiration.

The significance of all these signs is inconstant and time-consuming in its determination. The diaphragmatic contours, the costo-phrenic angles, and the position of the clavicles furnished the best evidence of the degree of inspiration. The first and second were only of value in diaphragmatic or so-called abdominal breathers, and the third in thoracic breathers.

Our effort to discover a single simple sign of the degree of inspiration was unfruitful until it was noted that in thoracic breathers the sternal ends of the clavicles raised during inspiration. In the abdominal type the clavicles moved little while the diaphragmatic dome showed a relatively wide excursion. It soon became obvious that the distance from the inner end of either clavicle to the middle point of the collateral hemidiaphragm is an index of the phase of respiration in nearly every patient, whether thoracic or abdominal breather. Studies instituted to determine the value of this sign showed that it bore a constant relationship to respiration when compared with

the width of the chest. When the clavicular diaphragmatic distance equals two-thirds to three-quarters of the width of the chest, the plate represents approximately complete inspiration; when only half the width of the chest, complete expiration (Fig. 5).

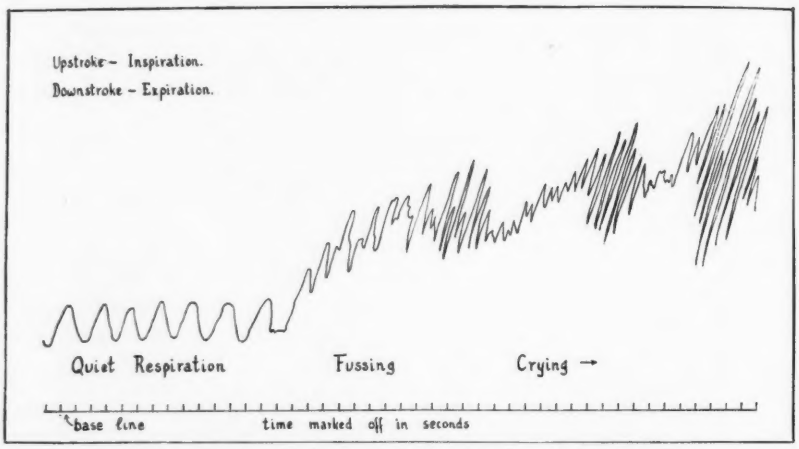


Fig. 4. Tracing of infant's respiration (Deming and Washburn).

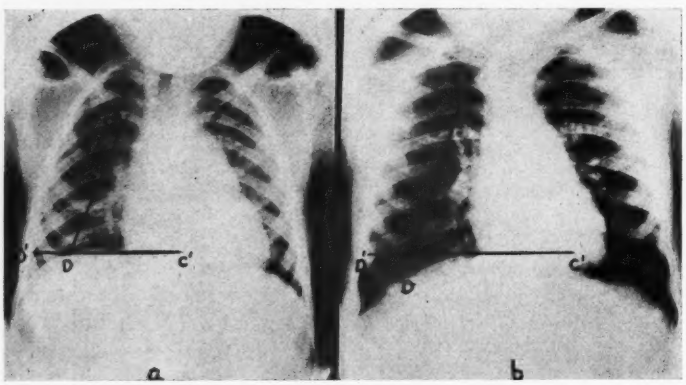


Fig. 5. When the clavicular diaphragmatic distance equals two-thirds to three-quarters of the width of the chest, the plate represents approximately complete inspiration; when only half the width of the chest, complete expiration.

CLINICAL AND EXPERIMENTAL EVIDENCE

Fifty co-operative children, 22 boys and 28 girls, were radiated at complete inspiration and expiration. These children varied in age from three to ten years. In these cases of known degree of inspiration the distance *cd* (Fig. 5) varied from six-tenths (0.6) to seven and one-half tenths (0.75), the width of the chest at complete inspiration. It varied from four and one-half tenths (0.45) to a little more than five-tenths (0.52), the width of the chest at complete expiration. Even in some cases in which the width of the chest varied because of unusual flaring of the lower ribs during inspiration we found the measurements to be within these limits.

Further clinical and experimental evidences of the accuracy of this sign was derived by radiating each of 20 unco-opera-

tive infants (eleven boys and nine girls, aged from one day to six weeks) while the entire head was enclosed in a steel cylinder equipped with a rubber collar which prevented any material escape of air. Respiration was traced on a smoked drum by means of a delicately balanced spirometer[3] (Fig. 6). The x-ray plates show many dif-

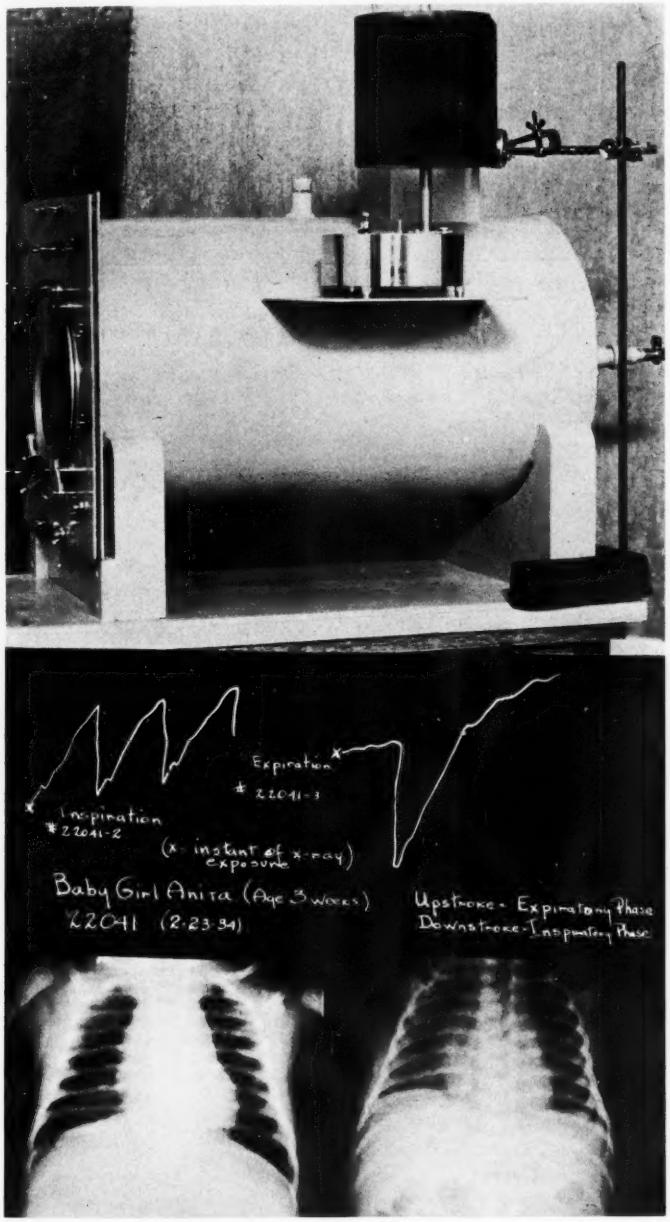


Fig. 6. Respiration traced on a smoked drum by means of a delicately balanced spirometer.

[3] Respiration in Infancy, J. Deming and A. H. Washburn, Am. Jour. Dis. Child., in press.

ferent phases of respiration. The instant of exposure was automatically recorded on the drum and thus indicated the exact phase of respiration at which each plate was made. Comparison of the clavicular diaphragmatic distance with the total width of the chest in these cases demonstrated the same relationship, numerically, as shown by the studies in the co-operative children. The younger the infant the closer the average relationship approached the minimum six-tenths (0.6) at inspiration.

We also studied the value of this x-ray sign in adults. By means of a spirometer which measured the air intake and output, plates were made at a known phase of respiration. In each instance the *cd* line (Fig. 5) varied within the limits ascribed to infants. The adults showed a relatively longer *cd* line compared with the width of the chest than the infants, because the complete inspiration of the adults was forced.

In order to demonstrate that muscular movement, without the egress or ingress of air, which does not change the relationship of the *cd* line to the width of the chest, the following test was made. Two physicians, whose mouths were held closed and whose noses were compressed so that no air could pass, were radiated during a strenuous muscular effort to inspire and a similar effort to exhale. These plates were compared with plates made at inspiration and expiration. The ineffectual efforts, by muscular contraction, to breathe had no effect on the *cd* line.

For a year we have used this simple method, of evaluating lung markings resulting from disease and differentiating them from those due to incomplete inspiration, at the Child Research Council, Children's Hospital, and other hospitals, and in private office work. We feel in this practical application that we have greatly enhanced the value of our interpretations of unco-operative children's chests. By use of a ruler we can arrive at an opinion as to the degree of inspiration in less than a minute. This method applies equally well when plates are made in the prone, supine, or erect postures.

SUMMARY

1. A knowledge of the degree of inspiration is essential to the proper interpretation of an x-ray examination of the lungs because a change in the respiratory phase changes the criteria upon which interpretation is based, especially in children.

2. There is no practical method of automatically exposing x-ray plates of the chest at complete inspiration in unco-operative patients.

3. A simple rapid method for determining the degree of inspiration from the plate itself is described.

4. Experimental and clinical evidence which supports the accuracy of this method is contributed.

CASE REPORTS AND NEW DEVICES

ROENTGENOLOGIC CHANGES IN THE TRANSVERSE COLON IN PERITONEAL TUBERCULOSIS[1]

Case Reports

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Brooklyn, N. Y.

From the Roentgen-ray Department of the Harbor Hospital

It is surprising how little roentgenologic literature can be found on the subject of peritoneal tuberculosis. Tubercular peritonitis may occur as an acute miliary tuberculosis or it may be secondary to a tubercular inflammation elsewhere. The process may be localized to one area or it may involve the entire peritoneum. The lesions themselves may be miliary in character or there may be large foci of new-formed tubercle tissue with considerable necrosis. There may be a more or less sero-fibrinous, purulent, or hemorrhagic exudate. Fibrous adhesions may form between the intestinal coils and the peritoneal wall, with encapsulation of the exudate. The tuberculous inflammation may be limited to the vicinity of the ulcers of the intestines. The process may involve the omentum, which is converted into a large, hard, thick dense mass lying in the upper part of the abdomen.

[1]Received for publication July 2, 1934.

The transverse colon serves as a point of attachment for the omentum and as the omentum is carried high up in the abdomen, it must carry the transverse colon with it. In the advanced case, one finds a rolled-up, sausage-shaped omentum closely associated with the transverse colon occupying an unusually high position in the abdomen.

The liver and spleen are very commonly involved in the tubercular process. Increase in size of both organs occurs as a result of the tuberculous infection.

If a roentgenologic study is made in a case of peritoneal tuberculosis in which a rolled-up omentum is present, one finds that the transverse colon is: (1) elevated, (2) fixed, (3) shortened, (4) inelastic. Definite changes also take place at the hepatic and splenic flexures—the former becomes flattened and the latter shows cupping.

Fig. 1. A four-hour plate of Case 1, showing the approximation of the stomach and transverse colon, the shortening and elevation of the transverse colon, the altered angles at the hepatic and splenic flexures, and the altered haustral state of the entire colon.

Fig. 2. A colon enema plate of Case 1, showing distinctly the elevation and shortening of the transverse colon, the cupping of the splenic flexure, and the altered angles at both flexures (greater than right-angles in this case).

The elevation, fixation, shortening, and loss of elasticity of the transverse colon needs no comment here, except to note that the degree varies with the extent of involvement of the omentum.

Just a word about the flattening of the hepatic flexure and the cupping of the splenic flexure. As the transverse colon is elevated, the ascending colon and descending colon do

Fig. 3. A forty-eight-hour plate of Case 2, showing the elevation and shortening of the transverse colon, the altered haustral state, and the altered angles at the flexures.

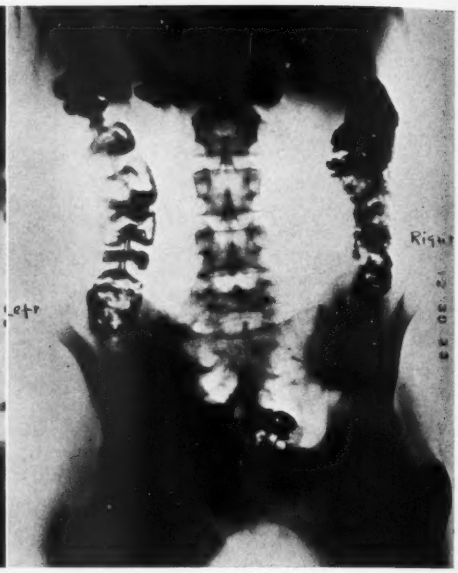

Fig. 4. A twenty-four-hour plate of Case 3, showing the elevation and shortening of the transverse colon, the widening of both flexure angles, the flattening of the apex of the hepatic flexure angle, and the cupping of the splenic flexure angles.

not participate to the same degree. At the same time there is an enlargement of the liver and spleen, producing a downward displacement of both flexures. As a result of both processes, the hepatic flexure becomes flattened and the splenic flexure becomes cupped. Adhesions between the flexures and the liver and spleen tend to accentuate this condition.

There are necessarily secondary changes in other organs resulting from the infection. The distance between the greater curvature of the stomach and the transverse colon becomes smaller. One also gets the impression that the stomach is foreshortened and the longitudinal axis decreased so that the stomach approaches the transverse type. The mobility of the stomach is somewhat impaired. In the chest the diaphragmatic motions may be decreased in amplitude. There are sure to be functional changes in the outline of the colonic wall itself, such as altered haustral states, probably reflexes from peritoneal irritation.

The above findings are not, of course, pathognomonic of peritoneal tuberculosis, since they may and do occur in other forms of peritonitis in which the omentum is involved in a similar process.

X-ray films and case histories of three cases of peritoneal tuberculosis, associated with rolled-up omentum, proven by operation, are presented below.

Case 1. B. M., female, age 20 years, complaining of pain in right side following an attack of indigestion. There is no nausea or vomiting. The appetite is poor. She has lost fifteen pounds in weight during the last two years. She has had night sweats for the past three months; no hemoptosis or cough.

Physical examination shows an anemic patient; the abdomen is tense, rigid, and distended; the spleen is palpable and extends almost to the umbilicus; the liver is not palpable. There is marked tenderness over the right lower quadrant. The heart and lungs are negative, as is the genito-urinary tract. The blood picture shows secondary anemia; the urine is negative.

Operation reveals a large amount of yellow fluid in the peritoneal cavity; the intestines held down by exudate; the peritoneum thick and studded with tubercles; the omentum rolled up and high in the abdomen.

Case 2. C. N., female, age 25 years, complaining of vomiting, diarrhea, and cramps for four months. The appetite is poor; there has been no loss of weight; no cough or hemoptosis.

Physical examination shows a patient with a secondary anemia. There is slight lower abdominal distention, and tenderness over the left lower quadrant. Intestinal loops are palpable at the time of cramps.

Operation reveals tuberculous involvement of the lower jejunal and ileal loops; the omentum is rolled up and high in the abdomen. The diagnosis is peritoneal tuberculosis.

Case 3. B. S., female, age 30 years, complaining of loss of appetite for the past six months. She noticed a mass in the abdomen three weeks prior to admission; pain has been present in the right lower quadrant.

Physical examination shows a mass the size of a grape fruit in the right mid-abdomen. Tenderness is present in the right lower quadrant; the abdomen is not distended.

Operation reveals a peritoneum studded with small tubercles. The omentum is thickened, rolled up, and high in the abdomen. The colon is covered with plastic exudate.

BIBLIOGRAPHY

SAMPSON, H. L., and HALPERT, B.: Roentgen-anatomic Studies of the Colon in 600 Patients with Pulmonary Tuberculosis. Am. Jour. Roentgenol. and Rad. Ther., November, 1931.

CHERRY, H. H.: Signs of Tuberculous Enterocolitis. Am. Jour. Roentgenol. and Rad. Ther., January, 1932, pages 65–81.

BROWN, L., and SAMPSON, H. L.: Early Roentgen Diagnosis of Ulcerative Tuberculous Colitis. Jour. Am. Med. Assn., 1919, pages 77–85.

IDEM: Intestinal Tuberculosis: Diagnosis and Treatment. Lea & Febiger, Philadelphia, 1926.

GOLDFARB, S. J., and SUSSMAN, M. L.: Chronic Hyperplastic Tuberculosis of Colon. Am. Jour. Roentgenol. and Rad. Ther., August, 1931, pages 324–329.

1219—49th Street

CALCIFICATION OF THE SPLENIC ARTERY

By JOHN E. HEATLEY, M.D., *Oklahoma City, Oklahoma*

From the Departments of Roentgenology and Anatomy of the State University of Oklahoma School of Medicine

Search of the literature does not reveal any mention of calcification of the splenic artery having been demonstrated by the x-ray. For this reason the following cases are submitted.

Figure 1 is an antero-posterior view of an anomalous calcified splenic artery in a white female aged 72, which was confirmed at operation. Following an operation for an abdominal injury, when 23 years of age, the patient was in bed for three years with drainage of pus from the abdomen. This history caused us to suspect the shadows of the splenic artery, shown in Figure 1, to be due to a rather opaque retained drainage tube. At operation a large calcified splenic artery was found.

We have seen six other cases with similar radiographic appearance, none of which were confirmed by operation or autopsy. None of the patients complained of pain over the region of the splenic artery. They had no symptoms in common. All patients except two were obese white females over 72 years of age. The number of these cases in our files would indicate that the condition is not uncommon. One case of calcified splenic artery had a small spleen, the splenic artery being slightly longer and more tortuous than the average.

Fig. 1.

A COMPOSITE UNIT FOR SINUS-MASTOID AND GASTRO-DUODENAL RADIOGRAPHY[1]

By W. W. ROBINSON, M.D., *Memphis, Tennessee*

This device supplies the need for a practical, compact, light-weight, inexpensive apparatus in the small laboratory, with which diagnostic stereoscopic radiographs of the nasal accessory sinuses and mastoids, as well as serialographic studies of the stomach and duodenum, may be made.

Its assembly incorporates two principles: First, that of the "Reflex" Sinus-mastoid Unit introduced by John R. Carty (1), of

[1] Presented before the Radiological Society of North America, at the Twentieth Annual Meeting, at Memphis, Tenn., Dec. 3–7, 1934.

the Cornell Medical Institute, and developed by the General Electric X-ray Corporation, and second, that of observing and positioning the stomach and duodenum with the fluoroscopic mirror as advocated by Lewis Gregory Cole (2), by means of which serial films may be made in various projections.

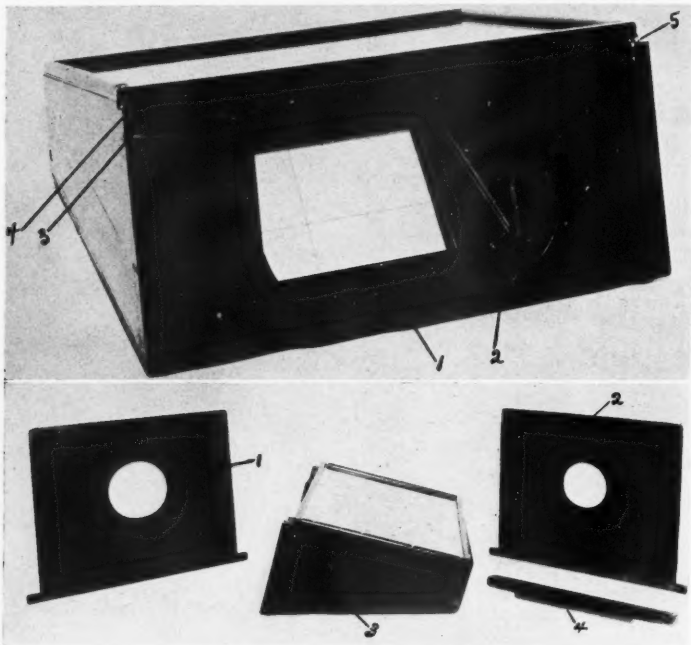

Fig. 1 (*above*). Unit dismantled showing: (1) adjustable mirror; (2) spring device for fixing mirror at desired angle; (3) lower tunnel for cassette or fluoroscopic screen; (4) upper tunnel for masks, and (5) spring-catch for holding mask in position.

Fig. 2 (*below*). Unit with accessories for sinus-mastoid radiography: (1) sinus mask; (2) mastoid mask; (3) unit with surface at 15° angle, and (4) removable cassette shelf.

The instrument is essentially the "Reflex" Sinus-mastoid Unit of modified size, with which we are probably all familiar, which may be readily converted into a horizontal serialographic table by means of two attachable legs, the utilization of two comfortably padded Bucky boards, and a removable fluoroscopic screen supported over a tilting mirror. Its top, made transparent with heavy celluloid, is reinforced by a heavy, rolled steel plate, which bears a 10-inch square opening, the center of which is indicated by two black perpendicular lines. Directly beneath the top are two tunnels, the upper one of which is shallow, and which is used for the leaded sinus, mastoid, and stomach masks. The sinus and mastoid masks have centrally placed, circular openings of 5 and 10 inches in diameter, respectively. Through these the topographical landmarks of the sinus and mastoid areas are reflected by visible light onto the mirror underneath, set at a 15-degree angle counterwise to the 15-degree angulation of the unit's surface. The stomach masks, two in number, each have a rectangular opening 8 by 10 inches in size, one parallel with the body plane and the other cross-wise of the body plane, so that either vertical or transverse types of stomachs may be intelligently examined and radiographed. All of the masks may be locked in position by two special spring-catches located on either side of the top of the unit.

The lower tunnel situated immediately beneath the mask tunnel is deeper. It serves to house the 8 by 10 inch cassettes, which in sinus and mastoid radiography may be shifted laterally along a removable shelf at the back of the tunnel to make single or double stereoscopic views, or to produce two exposures on a single 8 by 10 inch film. For the gastroduodenal examination this lower tunnel supports the fluoroscopic screen mounted in a

wooden frame, covered on its lower surface by a leaded glass, on which are opaque cross-wires corresponding in position to the centering lines on the transparent celluloid top. With the room darkened, an over-head tube with patient is maneuvered into different positions. The Patterson B type fluoroscopic screen is used for this work because of the increased detail it furnishes. A ferrochrome, 10 K.W., line-focus tube, or, better still, the new ray-

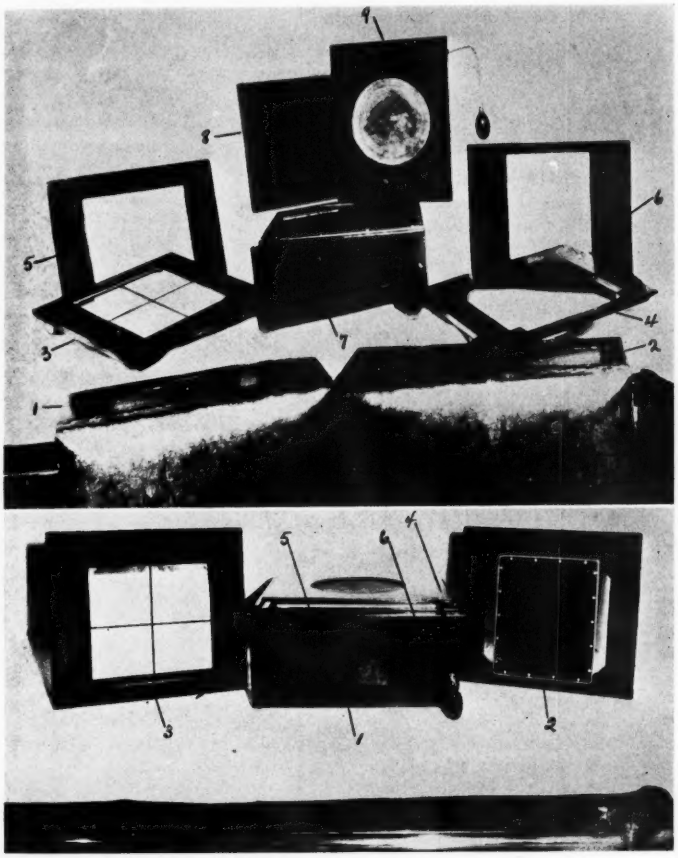

Fig. 3 (*above*). Unit with accessories for gastro-duodenal radiography: (1) and (2) comfortably padded Bucky cushions; (3) fluoroscopic screen with centering wires mounted in wooden frame; (4) wooden frame cassette holder; (5) stomach mask for transverse type; (6) stomach mask for vertical type; (7) unit in horizontal position with leg attached; (8) Lysholm grid, and (9) compression device.

Fig. 4 (*below*). Inspection of unit in horizontal position: (1) looking directly into mirror dropped to 45° angle, note reflection of Lysholm grid; (2) cassette holder with 8 × 10 cassette in transverse position; (3) fluoroscopic screen with centering wires, used interchangeably in lower tunnel with cassette holder; (4) compression device in its normal position for all gastro-duodenal radiography; (5) note Lysholm grid directly beneath compression device, and (6) transverse stomach mask in position in upper tunnel.

6-inch cone attached is energized with a fluoroscopic setting. The gastric and duodenal shadows are projected onto the mirror underneath, which is dropped to a convenient angle to increase visual acuity. The various phenomena are critically studied as the proof, shockproof tube of like capacity, is a necessary and valuable adjunct to the proper visualization of shadows in that very little or no white light is emitted into the room. Moreover, the shockproof tube permits the operator to examine the patient without fear of acci-

dental high tension shock. After the desired image is properly centered by means of the shadows of the cross-wires in the mirror, the fluoroscopic screen is removed, and an 8 by 10 inch cassette is inserted in the tunnel in either the transverse or longitudinal body plane by the use of a wooden frame specially constructed for the purpose. A series of 8 by 10 inch films are made in several positions for study.

The apparatus is well adapted to the use of the Lysholm grid of the $12^1/_2$ by $13^1/_2$ inch size, both for screening and plating the stomach and duodenum. On account of the increased definition it offers, it is used routinely in all of our cases. The reduction in intensity of radiation by its employment in radiography is compensated for by the addition of only 10 K.V.P. to the tube factors.

For radiographs taken under compression as well as those protraying the mucosal pattern of the stomach and cap according to Chaoul and Akerlund, a rubber bladder countersunk in a 9-inch circular aperture in a wooden frame, and operated by a rubber bulb and two-way valve (similar in principle to that embodied in the Improved Cassette Holder of Heylmun and Mayfield, 3) is placed over the surface of the unit. Counter-pressure on the stomach and cap may be exerted in any degree in any position. It may be employed in conjunction with the Lysholm grid; and deflated, it may be left in position during all of the gastro-duodenal examinations.

It is believed that the low cost of films used, and the wealth of detail and contrast shown in these, along with the optimum in position secured by the device, which is so essential to accurate diagnostic interpretation, should fully compensate the roentgenologist for its installation.

Although permission is granted any company to manufacture it, the author offers this innovation to the profession with the sincere wish that it shall never be patented or commercialized in any manner. He also wishes to commend Mr. T. G. Drane, of Memphis, for the earnest co-operation and mechanical skill shown by him in building the apparatus.

BIBLIOGRAPHY

(1) CARTY, JOHN R.: "Reflex" Head Unit Visualizes Position for Sinus-mastoid. Victor News, March, 1933, **5**, No. 2.

(2) COLE, LEWIS GREGORY: Gastro-intestinal Tract. RADIOLOGY, March and May, 1932, **18**, 471–520, 886–941.

(3) HEYLMUN, H. H., and MAYFIELD, C.: An Improved Cassette Holder. RADIOLOGY, November, 1933, **21**, 494.

1291 Union Ave.

AN AID IN DETERMINING THE POSITION OF THE UTERUS

By JOHN M. KEICHLINE, M.D., *Huntingdon, Pa.*

I wish to report a case in which retroflexion of the uterus was accidentally discovered at roentgen-ray examination.

Two young married women were sent to me for x-ray examination of the coccygeal region. On developing the films I found that both of them were wearing stem pessaries. The positions of the pessaries were so diametrically opposite that I reported the position of one as being highly suggestive of a retro-flexed uterus (Fig. 1). The patient's physician said he had examined her and that the uterus was in a normal position.

I later learned that this young woman was pregnant and that she had consulted an obstetrician. I at once told him of my findings and

Fig. 1.

he replied that they had been correct. He discovered the malposition in his examination and had replaced the uterus.

This report may serve to call attention to cases in which there is a question of retroflexion of the uterus.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

ARE WE MAKING PROGRESS IN DIAGNOSING CANCER IN ITS EARLY STAGES?

We radiologists have observed repeatedly that a large percentage of the cancer cases we diagnose and treat are far advanced when we first see them, and no doubt physicians of other specialties have had the same experience. This serious condition has been the cause for a great deal of thought and investigation on the part of the medical profession. All of us appreciate that the early recognition of cancer would materially reduce its mortality rate. It is apparent that many of the early cancer cases go undiagnosed, or else they do not produce sufficient symptoms to cause the patient to seek the advice of a physician. Be that as it may, we have to admit that little progress is being made in the early recognition of cancer, due either to the fault of the attending physician or the patient himself.

Recently MacCarty, of the Mayo Clinic, mentioned the following facts in a discussion of why cancer is not recognized early:

(1) From 30 to 50 per cent of cases of cancer of the breast (Harrington); 42 per cent of cases of cancer of the large intestine (Rankin), and 75 per cent of cases of the stomach (Balfour) are inoperable when first seen in the Mayo Clinic.

(2) Sixty-two per cent of the operable cancers of the breast, 38 per cent of cancers of the large intestine, and 53.5 per cent of cancers of the stomach have metastasized to regional lymph nodes when seen.

(3) The average size of operable cancers of the breast is 3.2 cm. in diameter, of those of the large intestine 6.4 cm., and of those of the stomach 6.1 centimeters.

(4) Only 29 per cent of operable cancers of the breast are smaller than a quarter (2.5 cm.), and this is true of only 2.2 per cent of cancers of the large intestines and only 6 per cent of cancers of the stomach.

While it is true that the lesions of early cancer are at times so small that it is impossible to recognize them macroscopically, if accessible to observation at all, yet the large majority are sufficiently large to be recognized if concerted effort is made. MacCarty reports that out of 7,179 specimens of surgically removed cancers, the smallest found in the breast was 2 mm. in diameter, in the large intestine 9 mm., and in the stomach 5 millimeters.

To say that a large number of early cancers are not recognized does not mean that medicine has not progressed comparable to the fields of industry and pure science; on the contrary, it has made rapid and startling strides in the diagnosis of disease and particularly cancer. In the early diagnosis of cancer, transillumination, aspiration biopsy, microscopical tissue examinations, and the use of the roentgen ray—the single or combined use of these agencies—all have been of tremendous importance. But in spite of this, we must admit that too many such cases are permitted to go unrecognized. Insufficient training and experience of the general medical men, too little regard for one's own limitations in this regard, and dependence on the roentgen ray in the hands of inexperienced and unqualified users of it are some of many causes for this apparent shortcoming of the medical profession. In this regard we heartily agree with MacCarty, that "Cancers are not recognized early by the medical profession and *never will be* until it learns that there are *no characteristic signs and symptoms* for early cancer and the *only means of telling whether the condition is gastric, duodenal, appendiceal, or in the gall bladder is the roentgen ray.*" What a tremendous difference it would make if the rank and file of the medical profession would recognize this truth; then and only then would a change become noticeable, instead of having to treat such a large number of hopeless and inoperable cancer cases.

There has been during the last few years a tremendous cancer educational program which has resulted in manifesting a great interest among the lay people concerning the cancer problem. It is to be hoped that its effect will be the means of cancer patients presenting themselves in the early stages of the disease.

The mortality rate of cancer is very high, much too high, but it can be materially reduced by the co-operation of the cancer patient with the medical profession, for an earlier diagnosis.

ANNOUNCEMENTS

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The following is a list of the diplomates of the American Board of Radiology who appeared before the Board and passed a satisfactory examination in Cleveland, Pittsburgh, or Memphis and who were granted certificates.

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4.	Allen, Moore Lowry	Philadelphia, Pa.	Radiology
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6.	Allison, R. G.	Minneapolis, Minn.	Roentgenology
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32.	Blaine, Edward S.	Los Angeles, Cal.	Roentgenology
33.	Bliss, Gerald D.	Altoona, Pa.	Radiology
34.	Bogan, Isabel Katherine	Boston, Mass.	Roentgenology
35.	Bogan, Mary Elizabeth	Brookline, Mass.	Roentgenology
36.	Bogart, Franklin B.	Chattanooga, Tenn.	Roentgenology
37.	Borzell, Francis Frank	Philadelphia, Pa.	Radiology
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39.	Bowing, H. H.	Rochester, Minn.	Therapeutic Radiology
40.	Brams, Julius	Chicago, Ill.	Radiology
41.	Brenneman, Richard E.	Meadville, Pa.	Therapeutic Radiology
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44.	Brouse, Ivan Edwin	Jacksonville, Ill.	Roentgenology
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46.	Brown, Samuel	Cincinnati, Ohio	Roentgenology
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56.	Cathcart, John Watson	El Paso, Tex.	Radiology
57.	Challenger, Chester John	Chicago, Ill.	Roentgenology

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66.	Coley, Stephen W.	Memphis, Tenn.	Roentgenology
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68.	Collins, John Joseph	Thomasville, Ga.	Radiology
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74.	Crossan, John W.	Los Angeles, Cal.	Diagnostic Roentgenology
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76.	Cunningham, Lester W.	Jacksonville, Fla.	Roentgenology
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79.	Dann, David S.	Kansas City, Mo.	Radiology
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82.	Davis, Kenneth S.	Los Angeles, Cal.	Roentgenology
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93.	Dunham, H. Kennon	Cincinnati, Ohio	Diagnostic Roentgenology
94.	Eastmond, Chas.	Brooklyn, N. Y.	Roentgenology
95.	Edwards, Harold Guegnon Fabien	Shreveport, La.	Radiology
96.	Edwards, James Bennett	Leonia, N. J.	Roentgenology
97.	Eley, Clayton W.	Norfolk, Va.	Roentgenology
98.	Elward, Joseph Francis	Washington, D. C.	Roentgenology
99.	Ernst, Edwin C.	St. Louis, Mo.	Radiology
100.	Erskine, Arthur Wright	Cedar Rapids, Iowa	Radiology
101.	Evans, William A.	Detroit, Mich.	Radiology
102.	Eveleth, Fred Shailer	Concord, N. H.	Roentgenology
103.	Farmer, Harry L.	Cleveland, Ohio	Radiology
104.	Farrell, John T., Jr.	Philadelphia, Pa.	Roentgenology
105.	Feaster, Orion Otis	St. Petersburg, Fla.	Radiology
106.	Ferguson, James W.	Pittsburgh, Pa.	Radiology
107.	Flynn, James Murray	Rochester, N. Y.	Radiology
108.	Ford, Frances A.	Detroit, Mich.	Radiology
109.	Fray, Walter Wendell	Rochester, N. Y.	Radiology
110.	Freedman, Eugene	Cleveland, Ohio	Roentgenology
111.	Freedman, John	Detroit, Mich.	Roentgenology
112.	Freid, Jacob R.	New York, N. Y.	Therapeutic Radiology
113.	Fricke, Robert Elmer	Rochester, Minn.	Therapeutic Radiology
114.	Friedman, Jacob	Montreal, Quebec	Roentgenology
115.	Friedman, Milton	Newark, N. J.	Therapeutic Radiology
116.	Furey, Warren W.	Chicago, Ill.	Radiology
117.	Garland, L. Henry	San Francisco, Cal.	Radiology
118.	Gates, Russell	Minot, N. D.	Roentgenology
119.	Gerber, Isaac	Providence, R. I.	Radiology
120.	Gershon-Cohen, Jacob	Philadelphia, Pa.	Radiology
121.	Geyman, Milton J.	Santa Barbara, Cal.	Diagnostic Roentgenology
122.	Gianturco, Cesare	Urbana, Ill.	Roentgenology
123.	Gillies, Carl L.	Cedar Rapids, Iowa	Radiology
124.	Goin, Lowell S.	Los Angeles, Cal.	Roentgenology
125.	Golden, Ross	New York, N. Y.	Roentgenology
126.	Goldsmith, Maurice F.	Pittsburgh, Pa.	Roentgenology
127.	Goodrich, Murray Eugene	Toledo, Ohio	Radiology
128.	Goodwin, Perry Bird	Peoria, Ill.	Radiology
129.	Gorsline, Clarence S.	Battle Creek, Mich.	Roentgenology
130.	Granger, Amédée	New Orleans, La.	Diagnostic Roentgenology
131.	Grier, George W.	Pittsburgh, Pa.	Radiology
132.	Groover, Thomas Allen	Washington, D. C.	Radiology

	Name	Address	Field
133.	Habbe, J. Edwin	Milwaukee, Wis.	Diagnostic Roentgenology
134.	Hall, E. Walter	Detroit, Mich.	Radiology
135.	Hankins, John Logan	Johnson City, Tenn.	Roentgenology
136.	Harding, Donnan B.	Lexington, Ky.	Radiology
137.	Harrington, Bernard D.	Tacoma, Wash.	Radiology
138.	Harris, John H.	Harrisburg, Pa.	Radiology
139.	Hartung, Adolph	Chicago, Ill.	Roentgenology
140.	Hasley, Clyde Knapp	Detroit, Mich.	Radiology
141.	Hauser, Harry	Cleveland, Ohio	Radiology
142.	Hawley, Sydney James	Danville, Pa.	Roentgenology
143.	Hay, Percy D., Jr.	Florence, S. C.	Radiology
144.	Heacock, Charles Hunter	Memphis, Tenn.	Roentgenology
145.	Healy, Thomas Raymond	Boston, Mass.	Roentgenology
146.	Heatley, John E.	Oklahoma City, Okla.	Diagnostic Roentgenology
147.	Heberding, John	Youngstown, Ohio	Radiology
148.	Hefke, Hans W.	Milwaukee, Wis.	Radiology
149.	Hendricks, Elliott Miley	Ft. Lauderdale, Fla.	Roentgenology
150.	Hendrickson, Anna R.	Canton, Ohio	Roentgenology
151.	Henry, Lucas Smith	Syracuse, N. Y.	Diagnostic Roentgenology
152.	Herpel, Frederick Karl	West Palm Beach, Fla.	Roentgenology
153.	Herrman, William Gettier	Asbury Park, N. J.	Radiology
154.	Hill, Walter Coit	Cleveland, Ohio	Roentgenology
155.	Hilt, Lawrence Mershon	Springfield, Ill.	Roentgenology
156.	Hodges, Fred Jenner	Ann Arbor, Mich.	Radiology
157.	Hodges, Fred M.	Richmond, Va.	Radiology
158.	Hodges, Paul C.	Chicago, Ill.	Radiology
159.	Holly, Leland E.	Muskegon, Mich.	Roentgenology
160.	Holmes, George Winslow	Boston, Mass.	Radiology
161.	Holmes, Ralph Williams	Chillicothe, Ohio	Roentgenology
162.	Howes, William Edward	Brooklyn, N. Y.	Radiology
163.	Hubeny, Maximilian John	Chicago, Ill.	Roentgenology
164.	Hufford, C. E.	Toledo, Ohio	Radiology
165.	Hunt, Howard B.	Omaha, Neb.	Radiology
166.	Hunter, James Wilson, Jr.	Norfolk, Va.	Radiology
167.	Ikeda, Kano	St. Paul, Minn.	Roentgenology
168.	Imboden, Harry M.	New York, N. Y.	Roentgenology
169.	Ivey, H. B.	Goldsboro, N. C.	Diagnostic Roentgenology
170.	Jaches, Leopold	New York, N. Y.	Radiology
171.	Jackson, Byron Hubbard	Scranton, Pa.	Radiology
172.	Jacox, Harold William	Ann Arbor, Mich.	Radiology
173.	Jarre, Hans A.	Detroit, Mich.	Radiology
174.	Jenkinson, Edward L.	Chicago, Ill.	Radiology
175.	Johnson, Ellsworth	Winchester, Va.	Diagnostic Roentgenology
176.	Johnson, Jesse B.	Galveston, Tex.	Radiology
177.	Johnson, Vincent Clifton	Ann Arbor, Mich.	Radiology
178.	Kahn, Max	Baltimore, Md.	Roentgenology
179.	Kalbfleisch, William K.	Wheeling, W. Va.	Roentgenology
180.	Kann, Ulysses S.	Binghamton, N. Y.	Radiology
181.	Kaplan, Ira I.	New York, N. Y.	Therapeutic Radiology
182.	Kasabach, Haig Haigouni	New York, N. Y.	Radiology
183.	Keichline, John M.	Huntingdon, Pa.	Radiology
184.	Keith, David Yandell	Louisville, Ky.	Radiology
185.	Kelly, James Francis	Omaha, Neb.	Radiology
186.	Kenning, John Carl	Detroit, Mich.	Radiology
187.	Kerby, James P.	Salt Lake City, Utah	Roentgenology
188.	Kerr, H. Dabney	Iowa City, Iowa	Radiology
189.	Kinney, Lyell Cary	San Diego, Cal.	Radiology
190.	Kirklin, B. R.	Rochester, Minn.	Radiology
191.	Kolvoord, Theodore	Battle Creek, Mich.	Diagnostic Roentgenology
192.	Kornblum, Karl	Philadelphia, Pa.	Radiology
193.	Kuegle, Frederick H.	Janesville, Wis.	Diagnostic Roentgenology
194.	Lafferty, Robert Hervey	Charlotte, N. C.	Radiology
195.	Lange, Sidney	Cincinnati, Ohio	Radiology
196.	Langer, Heinz	Pittsburgh, Pa.	Therapeutic Radiology
197.	Larkey, Charles J.	Bayonne, N. J.	Diagnostic Roentgenology
198.	Lattman, Isidore	Washington, D. C.	Radiology
199.	Lawrence, W. S.	Memphis, Tenn.	Radiology
200.	Leddy, Eugene Thomas	Rochester, Minn.	Radiology
201.	Leibert, Harry F.	Bethlehem, Pa.	Roentgenology
202.	Lenz, Maurice	New York, N. Y.	Therapeutic Radiology
203.	Leonard, Ralph D.	Boston, Mass.	Roentgenology
204.	Leucutia, Traian	Detroit, Mich.	Radiology
205.	Levi, Irwin P.	Anniston, Ala.	Diagnostic Roentgenology
206.	Le Vine, David	Eldorado, Ark.	Diagnostic Roentgenology
207.	Levyn, Lester	Buffalo, N. Y.	Diagnostic Roentgenology
208.	Lhevine, Morris B.	Tulsa, Okla.	Roentgenology

	Name	Address	Field
209.	Lingeman, Leslie Roberts	Rochester, N. Y.	Roentgenology
210.	Littig, Lawrence Victor	Madison, Wis.	Diagnostic Roentgenology
211.	Lochry, Ralph L.	Indianapolis, Ind.	Roentgenology
212.	Lockwood, Ira H.	Kansas City, Mo.	Radiology
213.	Lucinian, Joseph H.	Miami, Fla.	Roentgenology
214.	Lutz, Jeremiah Fletcher	York, Pa.	Roentgenology
215.	McClure, Christopher C.	Nashville, Tenn.	Radiology
216.	McCormick, Arthur Foster	Dubois, Pa.	Diagnostic Roentgenology
217.	McCormick, Henry Garnsey	Laurel, Miss.	Roentgenology
218.	McCullough, John Fife	Pittsburgh, Pa.	Radiology
219.	McDeed, Winfield G.	Houston, Tex.	Roentgenology
220.	McDermott, Joseph L.	Kansas City, Mo.	Radiology
221.	McElfatrick, George Charles	Wilmington, Del.	Roentgenology
222.	McGee, Harry Hand	Savannah, Ga.	Diagnostic Roentgenology
223.	McGuffin, W. Herbert	Calgary, Alberta	Radiology
224.	McHenry, R. K.	Houston, Tex.	Roentgenology
225.	McKinney, Joseph T.	Roanoke, Va.	Roentgenology
226.	McNamee, Edgar Paul	Cleveland, Ohio	Diagnostic Roentgenology
227.	McNutt, John Roscoe	Duluth, Minn.	Radiology
228.	Magruder, L. Freeland	Norfolk, Va.	Radiology
229.	Maier, Roe J.	Chicago, Ill.	Radiology
230.	Malone, L. A.	Terre Haute, Ind.	Diagnostic Roentgenology
231.	Mandeville, Frederick B.	Richmond, Va.	Roentgenology
232.	Manges, Willis F.	Philadelphia, Pa.	Radiology
233.	Marquis, W. James	Newark, N. J.	Roentgenology
234.	Martin, Charles Louis	Dallas, Tex.	Radiology
235.	Martin, James Madison	Dallas. Tex.	Radiology
236.	May, Ernst Albert	East Orange, N. J.	Radiology
237.	May, Robert John	Cleveland, Ohio	Radiology
238.	Mayfield, Claud	Long Beach, Cal.	Diagnostic Roentgenology
239.	Meadows, James Allen	Birmingham, Ala.	Radiology
240.	Meland, Orville Newton	Los Angeles, Cal.	Therapeutic Radiology
241.	Menees, Thomas Orville	Grand Rapids, Mich.	Radiology
242.	Menville, Leon J.	New Orleans, La.	Radiology
243.	Merchant, Albert K.	Philadelphia, Pa.	Radiology
244.	Meyer, Keith Thomas	Evansville, Ind.	Roentgenology
245.	Meyer, William H.	New York, N. Y.	Radiology
246.	Milkman, Louis A.	Scranton, Pa.	Roentgenology
247.	Minor, Edward G.	Detroit, Mich.	Diagnostic Roentgenology
248.	Moore, A. B.	Washington, D. C.	Radiology
249.	Moore, Claude	Washington, D. C.	Radiology
250.	Moore, John Jay	Washington, D. C.	Radiology
251.	Moore, Paul David	Muncie, Indiana	Radiology
252.	Moore, Sherwood	St. Louis, Mo.	Radiology
253.	Moore, Vernor Milo	Grand Rapids, Mich.	Radiology
254.	Morse, Russell Wright	Minneapolis, Minn.	Roentgenology
255.	Morton, Silvanus Archibald	Milwaukee, Wis.	Radiology
256.	Moxness, Bennie Arthur	Northampton, Mass.	Diagnostic Roentgenology
257.	Mulligan, Peter Burrill	Ashland, Pa.	Roentgenology
258.	Murphy, Gibbons Westbrook	Asheville, N. C.	Roentgenology
259.	Murphy, John T.	Toledo, Ohio	Radiology
260.	Myers, Ralph E.	Oklahoma City, Okla.	Radiology
261.	Nessa, Nelius Julian	Sioux Falls, S. D.	Roentgenology
262.	Newcomet, William Stell	Philadelphia, Pa.	Radiology
263.	Nichols, Bernard H.	Cleveland, Ohio	Radiology
264.	Nichols, Harold E.	Seattle, Wash.	Diagnostic Roentgenology
265.	Nordin, Gustaf Theodore	Minneapolis, Minn.	Radiology
266.	O'Brien, Frederick William	Boston, Mass.	Radiology
267.	Olin, Harry	Chicago, Ill.	Roentgenology
268.	Orndoff, Benjamin Harry	Chicago, Ill.	Radiology
269.	Orr, Clifford R.	Buffalo, N. Y.	Radiology
270.	Osmond, John D.	Cleveland, Ohio	Roentgenology
271.	Overgaard, Anders P.	Omaha, Nebraska	Radiology
272.	Owen, Arthur K.	Topeka, Kansas	Roentgenology
273.	Paine, Robert	Memphis, Tenn.	Radiology
274.	Palmer, Dorwin Lewis	Portland, Ore.	Radiology
275.	Pancoast, Henry K.	Philadelphia, Pa.	Radiology
276.	Pawling, Jesse R.	Watertown, N. Y.	Diagnostic Roentgenology
277.	Peden, Joseph C.	St. Louis, Mo.	Roentgenology
278.	Peirce, Carleton Barnhart	Ann Arbor, Mich.	Radiology
279.	Pendergrass, Eugene Percival	Philadelphia, Pa.	Radiology
280.	Perry, Gentz	Evanston, Ill.	Radiology
281.	Peters, Chester M.	Canton, Ohio	Radiology
282.	Peterson, Charles Hanson	Roanoke, Va.	Roentgenology
283.	Peterson, Vernon L.	Charleston, W. Va.	Radiology

	Name	Address	Field
284.	Pfahler, George Edward	Philadelphia, Pa.	Radiology
285.	Phillips, Clyde Columbus	Charlotte, N. C.	Radiology
286.	Pierce, Harold J.	Terre Haute, Ind.	Radiology
287.	Pierson, John William	Baltimore, Md.	Roentgenology
288.	Pindell, Merl Lee	Los Angeles, Cal.	Diagnostic Roentgenology
289.	Pirie, Alexander Howard	Montreal, Quebec	Radiology
290.	Pitts, Thomas A.	Columbia, S. C.	Roentgenology
291.	Podlasky, Harry Bernard	Milwaukee, Wis.	Roentgenology
292.	Pohle, Ernst Albert	Madison, Wis.	Therapeutic Radiology
293.	Pomeranz, Maurice M.	New York, N. Y.	Radiology
294.	Pomeroy, Lawrence A.	Cleveland, Ohio	Radium Therapy
295.	Portmann, Ursus V.	Cleveland, Ohio	Radiology
296.	Potter, Carlton Frasier	Syracuse, N. Y.	Roentgenology
297.	Potter, Hollis	Chicago, Ill.	Roentgenology
298.	Potter, Roy Pilling	Marshfield, Wis.	Roentgenology
299.	Powers, Martin Thomas	Utica, N. Y.	Diagnostic Roentgenology
300.	Prouty, James V.	Terre Haute, Ind.	Radiology
301.	Putts, B. Swayne	Erie, Pa.	Roentgenology
302.	Quick, Douglas	New York, N. Y.	Therapeutic Radiology
303.	Quimby, A. Judson	New York, N. Y.	Roentgenology
304.	Quiney, James J.	Easton, Pa.	Radiology
305.	Raap, Gerard	Miami, Florida	Radiology
306.	Rauschenbach, Charles Wm.	Hammond, Ind.	Roentgenology
307.	Ray, William Burton Getty	Pittsburgh, Pa.	Roentgenology
308.	Reaves, Hugh G.	Knoxville, Tenn.	Roentgenology
309.	Reeves, Robert James	Durham, N. C.	Radiology
310.	Reineke, Harold G.	Cincinnati, Ohio	Diagnostic Roentgenology
311.	Reitter, George Stiles	East Orange, N. J.	Radiology
312.	Reynolds, Lawrence	Detroit, Mich.	Radiology
313.	Rhinehart, Darmon A.	Little Rock, Ark.	Roentgenology
314.	Rigler, Leo G.	Minneapolis, Minn.	Radiology
315.	Ritvo, Max	Boston, Mass.	Radiology
316.	Ritzman, Allen Z.	Harrisburg, Pa.	Roentgenology
317.	Robins, Samuel Alexander	Boston, Mass.	Roentgenology
318.	Robinson, Ralph V.	Pittsburgh, Pa.	Roentgenology
319.	Robinson, Walter W.	Memphis, Tenn.	Roentgenology
320.	Rodgers, Floyd D.	Columbia, S. C.	Radiology
321.	Rodríguez, Juan	Fort Wayne, Ind.	Diagnostic Roentgenology
322.	Roland, Marion Mansfield	Oklahoma City, Okla.	Therapeutic Radiology
323.	Rose, Cassie Belle	Chicago, Ill.	Radiology
324.	Rosenbaum, George	Philadelphia, Pa.	Diagnostic Roentgenology
325.	Rousseau, James P.	Winston Salem, N. C.	Radiology
326.	Rowe, Edward W.	Lincoln, Neb.	Radiology
327.	Rudisill, Hillyer, Jr.	Charleston, S. C.	Radiology
328.	Rutledge, Clifford P.	Shreveport, La.	Diagnostic Roentgenology
329.	Rypins, Edwin Louis	Iowa City, Iowa	Radiology
330.	Sante, L. R.	St. Louis, Mo.	Radiology
331.	Schmitz, Henry	Chicago, Ill.	Therapeutic Radiology
332.	Schons, Edward	St. Paul, Minn.	Radiology
333.	Sharpe, A. Maxwell	Chester, Pa.	Roentgenology
334.	Shaw, Wilfred McLaurin	Jacksonville, Fla.	Roentgenology
335.	Sherrick, Earl C.	Connellsville, Pa.	Diagnostic Roentgenology
336.	Shiflett, E. Lee	Indianapolis, Ind.	Roentgenology
337.	Sims, George P.	Columbus, Ohio	Therapeutic Radiology
338.	Skinner, Edward Holman	Kansas City, Mo.	Radiology
339.	Smith, Lester A.	Indianapolis, Ind.	Radiology
340.	Smyth, Thos. L.	Allentown, Pa.	Roentgenology
341.	Snow, Henry	Dayton, Ohio	Radiology
342.	Snure, Henry	Los Angeles, Cal.	Roentgenology
343.	Soiland, Albert	Los Angeles, Cal.	Radiology
344.	Sosman, Merrill C.	Boston, Mass.	Radiology
345.	Spangler, Davis	Dallas, Tex.	Radiology
346.	Spencer, Hunter B.	Lynchburg, Va.	Roentgenology
347.	Spilman, Harold Augustus	Ottumwa, Iowa	Roentgenology
348.	Spinzig, Edgar Walter	St. Louis, Mo.	Radiology
349.	Sproull, John	Haverhill, Mass.	Roentgenology
350.	Stayton, Chester A.	Indianapolis, Ind.	Roentgenology
351.	Steel, David	Cleveland, Ohio	Roentgenology
352.	Steiner, Joseph M.	New York, N. Y.	Roentgenology
353.	Stephenson, Frank Butler	Denver, Col.	Radiology
354.	Stevens, Rollin Howard	Detroit, Mich.	Radiology
355.	Stewart, William H.	New York, N. Y.	Roentgenology
356.	Stone, Robert S.	San Francisco, Cal.	Roentgenology
357.	Sutherland, Charles G.	Rochester, Minn.	Diagnostic Roentgenology
358.	Swenson, Paul C.	New York, N. Y.	Roentgenology

	Name	Address	Field
359.	Swope, Opie William	Wichita, Kansas	Radiology
360.	Taft, Robert B.	Charleston, S. C.	Radiology
361.	Taylor, Clifford C.	Indianapolis, Ind.	Radiology
362.	Taylor, Henry Keller	New York, N. Y.	Diagnostic Roentgenology
363.	Taylor, Raymond G.	Los Angeles, Cal.	Radiology
364.	Thomas, Merthyn Arthur	Cleveland, Ohio	Radiology
365.	Thompson, Harold B.	Seattle, Wash.	Radiology
366.	Tice, Galen M.	Kansas City, Kans.	Radiology
367.	Titterington, Paul F.	St. Louis, Mo.	Roentgenology
368.	Trostler, I. S.	Chicago, Ill.	Roentgenology
369.	Troup, Ralph L.	Green Bay, Wis.	Radiology
370.	Troxell, Wm. Chas.	Allentown, Pa.	Roentgenology
371.	Tyler, Albert Franklin	Omaha, Neb.	Radiology
372.	Ude, Walter Herman	Minneapolis, Minn.	Roentgenology
373.	Ulbrich, Henry L.	Detroit, Mich.	Roentgenology
374.	Upson, Wilbur Owen	Battle Creek, Mich.	Radiology
375.	Van Allen, Harvey Ward	Springfield, Mass.	Radiology
376.	Van Buskirk, Edmund Michael	Ft. Wayne, Ind.	Roentgenology
377.	Velkoff, Metodi	Ft. Wayne, Ind.	Roentgenology
378.	Virden, C. Edgar	Kansas City, Mo.	Radiology
379.	Vogt, Edward C.	Boston, Mass.	Roentgenology
380.	Voke, Edward Lawrence	Akron, Ohio	Diagnostic Roentgenology
381.	Von Poswik, Gisela	Scranton, Pa.	Roentgenology
382.	Walton, Henry Janney	Baltimore, Md.	Radiology
383.	Wasson, W. W.	Denver, Col.	Radiology
384.	Waters, Charles A.	Baltimore, Md.	Roentgenology
385.	Watkins, W. Warner	Phoenix, Ariz.	Radiology
386.	Weaver, Clarence E.	Detroit, Mich.	Roentgenology
387.	Webb, James A. H.	Wichita, Kans.	Roentgenology
388.	Weber, Harry Matthew	Rochester, Minn.	Roentgenology
389.	Wescott, William Carter	Atlantic City, N. J.	Radiology
390.	West, James H.	Cleveland, Ohio	Radiology
391.	West, Theodore	Port Chester, N. Y.	Roentgenology
392.	Whitlock, Simon Ben	Norfolk, Va.	Roentgenology
393.	Widmann, Bernard Pierre	Philadelphia, Pa.	Radiology
394.	Wigby, Palmer E.	Dallas, Texas	Radiology
395.	Williams, Lester James	Baton Rouge, La.	Radiology
396.	Willy, Ralph Gilmer	Chicago, Ill.	Roentgenology
397.	Wilson, Stanley A.	Burlington, Vt.	Roentgenology
398.	Withers, Sanford	Denver, Col.	Therapeutic Radiology
399.	Witwer, Eldwin Roy	Detroit, Mich.	Radiology
400.	Wright, C. S.	Indianapolis, Ind.	Diagnostic Roentgenology
401.	Wurster, Lloyd Edward	Williamsport, Pa.	Diagnostic Roentgenology
402.	Young, Barton R.	Philadelphia, Pa.	Radiology
403.	Zink, Oscar Charles	St. Louis, Mo.	Radiology
404.	Zulick, J. Donald	Philadelphia, Pa.	Roentgenology

There will be two meetings of the Board in 1935 for the purpose of conducting examinations. The first will be in Yosemite, California, some time between May 10 and 15, and the second in Atlantic City, New Jersey, about June 8, 9, and 10. Any applicant wishing to appear before the Board in Yosemite must have his application in the Secretary's office not later than March 1, and any one desiring to appear before the Board in Atlantic City must have his application on file by April 1.

B. R. KIRKLIN, M.D.,
Secretary-Treasurer,
The American Board of Radiology

RADIOLOGISTS-HOSPITALS COMMITTEE REPORT[1]

DR. E. L. JENKINSON (Chicago): First, I want to take this opportunity to thank a great many of the members of the Society for cooperating in bringing about this report. I want especially to thank Dr. Christie and Dr. Chamberlain, who were a great aid in the consummation of this report.

To the President and Members of the Radiological Society of North America: Persuant to the resolution passed at the last annual meeting of the Society, a Hospital-radiologist Committee was appointed by the Executive Committee.

This Committee has investigated the problem by circularizing many hospitals and radiologists in the United States and Canada, and by considerable study of the matter. The Committee begs to offer the following preliminary report:

[1] From the minutes of the Annual Meeting, Dec. 3-7, 1934.

1. The practice of radiology is the practice of medicine and is no more a part of the corporate activity of a hospital than is any other branch of medical practice. Radiologists are subject to the same Code of Ethics as other members of the American Medical Association, and hospitals should be bound by the same Code of Ethics in their relation with radiologists.

2. The hospital has a right to an adequate and fair return for obsolescence on x-ray equipment, rental for space occupied and charges for heat, light, water, telephone and janitor service, and similar expenses.

3. The hospital is not entitled to any part of the net return from the professional services of the radiologist.

4. To assure an equitable return to the hospital and an equitable status to the radiologist on its staff, a rental type of appointment would appear to be the simplest and most effective. By this is meant that the radiologist would rent space, or space and equipment, from the hospital, paying the latter a monthly sum, this rent to be based on the factors mentioned above (see Section 2).

5. The rental type of appointment is believed to be the most equitable one, both for the hospital and for the radiologist. However, your Committee realizes that many radiologists and hospitals are operating under a percentage or salary agreement. Under these circumstances, the above-stated ethical principles should become operative at the earliest possible moment. Under existing arrangements it is of especial importance that the radiologist should have complete charge of the department including the fixing of fees, the control of personnel, and the submission of bills to patients on his own personal billhead, whether this be done by himself or by the hospital.

6. An Arbitration Committee should be formed in each community consisting of one or two hospital executives, one or two radiologists and one or two general physicians or surgeons. It would be the duty of this committee, in case of dispute, to settle such questions as the amount of space needed for the department, the necessity for replacement of equipment, the rental to be charged, and similar questions.

7. Your Committee believes that the practice of radiology in hospitals should be in the hands of the physician and that the responsibility of employing and discharging technicians, determining fees, and rendering and collecting bills should be his.

8. It is recognized that the hospital has authority through its executive medical staff, to terminate the appointment of its radiologist on reasonable grounds and after due notice, similar grounds and notice being open to the radiologist should voluntary resignation be advisable.

9. In hospitals wherein all members of the staff are on salary or where all members are compensated in some manner other than that outlined above, it is obvious that the radiologist should be compensated in the same manner as his medical *confrères*.

10. Since the personal relation between the patient and his doctor is fundamental in medical practice, any plan that tends to prevent such is detrimental to radiology. Therefore, we believe that radiologists' services should not be included in any flat rate or group hospitalization plan. We wish further to emphasize the dangers of the artificial division of the x-ray examination into so-called technical and professional portions. It is our conviction that the integrity of radiology cannot be maintained under such division.

11. Your Committee believes that adherence to the above-outlined principles is the only method which will insure to patients and hospitals the maintenance of radiology on the high level commensurate with their best interests.

12. Your Committee recommends that a copy of this report be sent to the American Roentgen Ray Society, the American College of Radiology, the American Radium Society, and the Section on Radiology of the American Medical Association, with a request for concurrence in the plan as outlined, and that copies should be sent to such other persons as individual members may wish.

13. The investigation of your Committee reveals the necessity for solidarity and co-operation not only of radiologists but of all branches of the medical profession, for the solution of the important economic problems before us, and therefore we recommend the formation of a national Radiological Economics Committee to be made up of two representatives from each of the radiological societies.

Your Committee is of the opinion that greatest progress in the settlement of the hospitals-radiologists problem will be made

only by national agreement on a plan embodying fundamental principles in which all radiologists concur.

14. Your Committee recommends, therefore, that the Executive Committee of the Radiological Society of North America be instructed to take such steps as may be necessary to bring about the formation of the intersociety committee recommended in this report.

COMMITTEE ON RADIOLOGISTS AND HOSPITALS

REPORT OF COMMITTEE ON INSURANCE[1]

Your Committee on Insurance presents the following report:

The second paragraph of the report of this Committee presented Sept. 25, 1933, at Chicago, read:

> The premium rates on medical malpractice insurance to roentgenologists have been increased in several States by insurance companies which have been furnishing this insurance at reduced rates in these States.

Since the presentation of that report, your Committee on Insurance is privileged to report a much more pleasing situation. Due to and in a large measure because of the continued activity of this Committee, a decidedly worthwhile reduction in malpractice insurance premiums has been made by one of the best of our insurance carriers, one in which a large number of our members carry their insurance.

In the States of Illinois, Indiana, Iowa, Kansas, Michigan, Ohio (except only the northern part), Pennsylvania, and Wisconsin there has been a reduction of 40 per cent from previous rates for malpractice insurance for radiologists using the roentgen rays for therapeutic purposes, and of 70 per cent for those using the roentgen rays for diagnosis only.

In northern Ohio the reduction is not quite so much but it is still a considerable amount less than formerly.

In the States of Missouri (except one county) and Texas this same insurance carrier has reduced the premium rate for radiologists doing roentgentherapy from $90 to $68 for the 5,000–15,000 contract and to $29 per year for those not doing therapy.

Relatively similar reductions, particularly those who are not doing roentgentherapy, have been made in other States, and these reductions in the premium rates have resulted in a saving of thousands of dollars to our members.

The usual number of members have made inquiries and have asked questions from the Chairman of this Committee, and we trust were satisfied with the replies.

It was recommended that the 1933 report of this Committee be published in RADIOLOGY and a motion was passed that that recommendation be approved so that the members of this Society might be informed as to the activities of the Society in this particular, but that report has not yet been published. This Committee now recommends that the Committee on Insurance be continued and that the Editor of RADIOLOGY be directed to publish this report in the earliest possible number of that publication.

Respectfully submitted by the Committee on Insurance,

I. S. TROSTLER, *Chairman*

[1] Annual Meeting, Memphis, Tenn., Dec. 3–7, 1934.

COMMUNICATIONS

SHOULD THE PATIENT BE TOLD?

FURTHER COMMENT

In the December, 1934, issue of RADIOLOGY appeared an editorial by Dr. Orville N. Meland with the above title. An appended footnote by the Editor invited further expressions of opinion on this subject. The following excerpt from a book entitled "Cancer: A Professional Responsibility and a Public Liability," by Albert Soiland, M.D., published in 1927 by D. Appleton & Co., is significant.

"Nowhere in the practice of medicine is the responsibility of the physician to the public greater than in the field of cancer. He must first be sure that he is dealing with cancer and this can usually be easily determined by modern diagnostic methods. Next, the patient must be made aware of the serious nature of the disease, and this must be done in the proper way and without any unnecessary shock. There are, of course, many individuals whom it might be wise not to inform of their condition. In such cases those nearest the patient must know about it. There are many situations which tax the skill and diplomacy of a physician but he would not be true to his calling or his duty to humanity if he did not

impart the right kind of information to those who should and must know it. If the disease is localized and in a location where it can be removed, with a good prospect of relief, and without immediate danger to the life of the patient, he or she can be freely assured of this fact. If, on the other hand, a person apparently in general good health is found to be harboring a cancer which has already invaded the interior structures, proper handling of this problem taxes the ingenuity and resourcefulness of the physician. It is no easy task to approach the apparently healthy individual and inform him that an active cancer is present in a form which will make successful treatment not only doubtful but useless. When an apparently normal individual walks into your examining room in seemingly good health, and you find an advanced cancer, and know that this patient cannot live more than a few months, the problem is pitifully complex. Yet despite this, it appears to be the solemn duty of the physician to inform such a patient or his nearest relatives that he must prepare his personal affairs to meet the inevitable end. This is indeed a grave responsibility and is one of daily occurrence with the physician whose practice brings him into contact with major cancer work." (Chapter VIII.)

Dr. Soiland makes a vitally important point, or so it seems to the Editor, in advising that the patient's nearest relatives shall be told, in case there appears to be valid reason for withholding from the patient himself knowledge of the true nature of his affliction.

FAMOUS MEDICAL JOURNAL EDITOR DIES

DR. LEWIS STEPHEN PILCHER

Dr. Lewis Stephen Pilcher, scholar and editor for half a century of the oldest surgical journal in the United States, the "Annals of Surgery," died Dec. 24, 1934, at the age of 89 years. Country school teacher, country practitioner, naval surgeon, student of tropical disease, anatomist, professor of surgery, editor, bibliophile, patriot—these nouns indicate a few of his many interests and activities over a long and intensely useful life.

In 1884 he became editor of the "Annals of Surgery," which position he occupied to the end of his life. The editorial policy of that journal and the censorship of its advertising were never relinquished by the Editor. If we add to the fifty years of the "Annals of Surgery," the seven years of the "Annals of Anatomy and Surgery," and its predecessor which he inspired and dominated, this period of medical editorship establishes Dr. Pilcher as the dean of medical editors in the United States, if not in the world.

MINNESOTA RADIOLOGICAL SOCIETY

The fall meeting of the Minnesota Radiological Society was held at Rochester, Minnesota, Oct. 13, 1934. The program was presented by the staff of the Mayo Clinic and was as follows:

1. Xanthomatosis: Clinical Aspects. R. L. J. Kennedy, M.D.; Roentgenologic Aspects. J. D. Camp, M.D.
2. Backache. R. K. Ghormley, M.D.
3. Interesting Diagnostic Problems. J. D. Coate, M.D.
4. Mortality Studies on Carcinoma of the Cervix. R. E. Fricke, M.D.
5. The Duodenal Niche. H. A. Burch, M.D.
6. Osteopoikiliosis and Allied Diseases of Bone. C. G. Sutherland, M.D.
7. Limits of Safety in Roentgenography. A. Turnbull, M.D.
8. The International Congress of Radiology at Zurich and St. Moritz. A. U. Desjardins, M.D.

Address: Some Effects of Radiation. C. Sheard, M.D.

RADIOLOGICAL SECTION OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION

The officers for the Radiological Section of the Los Angeles County Medical Association for 1935 are as follows: *President*, Clayton Johnson, M.D.; *Vice-president*, J. W. Crosson, M.D.; *Treasurer*, Henry Snure, M.D., and *Secretary*, E. N. Liljedahl, M.D.

Meetings are held the fourth Wednesday of the month.

FLORIDA STATE RADIOLOGICAL SOCIETY

The Meeting of the Florida State Radiological Society was held on Oct. 27, 1934, in St. Petersburg, Florida. The Society was the guest of Dr. Stevens of the United States Veterans Hospital.

The following officers were elected for the coming year: Frederick K. Herpel, M.D., *President;* W. McL. Shaw, M.D., *Vice-President;* Frazier J. Payton, M.D., *Secretary-Treasurer.*

The meeting consisted of a morning session—a round-table discussion of interesting and problematical cases. The afternoon session consisted of a symposium on radiation therapy led by Dr. Cunningham, of Jacksonville, Florida. The radiologists attended dinner together at the Seminole Club, St. Petersburg. Dinner was followed by an evening session, devoted to economics.

THE XI ITALIAN CONGRESS OF MEDICAL RADIOLOGY

PERUGIA, SEPT. 20, 22, 1934

The XI Congress of the Italian Society of Medical Radiology, which was founded twenty-two years ago and whose membership amounts at present to about five hundred, was held in Perugia, where it developed its work, and was attended by a large number of persons interested in that science. The work carried out was of great importance and the subjects treated particularly interesting, as, for instance—

(1) Traumatic affections and lesions of the spinal column (Prof. Lapenna);
(2) Radiotherapy of the encephalos (Prof. Palmieri);
(3) Radiotherapy of the peripheric nervous system (Prof. Del Buono);
(4) Radiotherapy of the sympathetic nerve;
(5) Modern methods of radiologic research (Prof. Benassi and Prof. Perone).

More than two hundred communications, most of which concerned the subjects treated in the Reports, were filed, and the discussions occasioned thereby proved of the greatest interest.

The General Assembly of the Members of the Society, which was held at the same time, gave the opportunity of taking into consideration a number of important questions such as the Teaching in the Universities, Hospital Service, and Private Practice in Connection with the New Corporative Dispositions.

The Board of Directors for the previous two years was confirmed under the Presidency of Prof. Siciliano, of Florence. Venice was voted by acclamation as the seat of the XII Congress, under the Presidency of Prof. Vespignani.

BOOK REVIEWS

RÖNTGEN GANZAUTNAHMEN DES MENSCHEN (TOTAL ROENTGENOGRAMS OF MAN): VIEWS OF THE NORMAL SKELETON, ITS HEREDITARY AND ACQUIRED CHANGES. By DR. ROBERT JANKER, Privatdozent at the University of Bonn, with a Foreword by PROF. DR. E. VON REDWITZ, of Bonn. With 40 illustrations and one stereo-picture. Published by J. A. Barth, Leipzig, 1934. Price, Rm. 65.

Only in Germany, probably, could an atlas of this character be produced in book form and in such an elaborate manner—such excursions into narrow fields appear to be economically impossible for the publishers of other countries. The author presents here the results of laborious experiments in the production of single roentgenograms of the entire body by a method which differs radically from that recently attempted in this country. The text is short and reasonably well translated into readable English, as are the captions of the forty-one full-page plates. The German and English versions appear in separate columns side by side.

Single films of sufficient size to more than cover the entire body were used. A tube-focus distance of 450 cm. was necessary to minimize the distortion, which would naturally be very great for an object of such large size. To attain detail with reasonable speed at such a distance required rather unusual tubes. The production of an even density for a single exposure which included phalanges and pelvis was accomplished by the use of a lead screen interposed for varying portions of the exposure over the thinner portions. In addition, by the exercise of great care during development, the use of reducing solutions, and other punctilious attention to detail, a fairly satisfactory result was achieved. The plates show, in fact, rather good soft tissue detail.

It is obvious from the description of the technic that the method is of no practical importance in everyday practice, yet for research in anatomy, for anthropological studies, and for teaching purposes the procedure may have great value.

In the plates, which are reproduced in remarkably fine fashion, are shown various types of normals and a number of examples of generalized bone diseases, such as chondrodystrophy, dwarfism, multiple benign cartilaginous exostoses, osteopsathyrosis, rachitic changes, and other diseases of like character. One case of osteitis deformans illustrates well the compara-

tive lack of detail which is probably inherent in the method, although the general changes in form are very well brought out.

The last plate represents a stereoscopic view of a skeleton apparently made by a more indirect method. The author describes this as a small photograph of the image of the skeleton produced on a roentgenoscopic screen of full body size. While the detail is not so good, he believes, yet this method may prove to be of more practical import because it is much less expensive. Unfortunately, details of this type of procedure are not given.

OUT OF THE TEST TUBE. By HARRY N. HOLMES, PH.D., Professor of Chemistry at Oberlin College, and Past Division Chairman of the American Chemical Society. A volume of 373 pages and 83 figures. Published by Ray Long and Richard R. Smith, Inc., New York City, 1934. Price, $3.00.

This is a most interesting account of recent advances in chemistry, together with their effects on civilization, and on the lives of all of us.

There is not much that will be new to the man who each week follows the progress of science and chemical industry in journals such as "Science News Letter," the "Scientific American," "Science," or "Fortune," but to the man who has not taken the time to keep informed as to how manufacturers developed duco, bakelite, rayon, cellophane, indigo, artificial rubber, methanol, acetylene, pyrex glass, duralumin, shatterproof glass, aniline dyes, neon signs, ethyl gasoline, artificial nitrates, etc., the book will be a mine of interesting information. It will give the reader not only a review of recent progress in, let us say, steel making, but it will take him back to ancient Egypt, where on the wall of a tomb he can see slaves working a series of bellows while the foundryman tends his little furnace.

The radiologist will be interested in Chapter XII on "The Fall of the House of Uranium," with its brief account of the discovery of radioactivity.

This should be a splendid book for the factory executive who has not yet learned that continued success in manufacturing must be based on constant research and the application of new discoveries in science. It is a fine book, also, for a boy or for anyone who wishes to be abreast of the times.

It is unfortunate that men and women to-day who use the automobile, the telephone, and the radio have not the remotest idea of what is under the hood or in the case. They do not know anything of the years of research that produced the nitrogen-filled lamp or the Coolidge tube, and they do not care to know. As a result, with their votes some day they may pass laws that will strike at the very foundations of all research and all advance in civilization, and because of their greed and ignorance they will kill the goose with the golden eggs.

ABSTRACTS OF CURRENT LITERATURE

CONTENTS BY SUBJECT

THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

J. N. Ané, M.D., of New Orleans
J. E. Habbe, M.D., of Milwaukee, Wisconsin
H. W. Hefke, M.D., of Milwaukee, Wisconsin
E. T. Leddy, M.D., of Rochester, Minnesota
Davis H. Pardoll, M.D., of Chicago
E. A. Pohle, M.D., Ph.D., of Madison, Wisconsin
Charles G. Sutherland, M.D., of Rochester, Minnesota

CONTENTS OF ABSTRACTS IN THIS ISSUE LISTED ALPHABETICALLY BY AUTHORS

BONE DISEASES (DIAGNOSIS)

Osteogenesis Imperfecta: Report of Two Cases. Samuel Kleinberg. Jour. Bone and Joint Surg., October, 1934, **16**, 953–958.

The author presents two cases of osteogenesis imperfecta representing, respectively, the congenital and the post-natal varieties of this condition. While the primary cause of the disease is unknown, it is believed that the chief change in the bone is a lack of complete development of the various constituents of bone tissue.

The first patient was an infant, two months old, who presented deformities of all the extremities resulting from fractures present at birth. The family history was negative for evidence of a similar malady. Roentgenographic examination of the entire skeleton revealed abnormal thinness of all the bones, with evidence of deformities due to healed fractures. The cortex appeared thin and the bone lamellæ atrophic and sparse. Therapy was directed to the correction of the deformities, combined with the administration of viosterol, halibut-liver oil, and ultra-violet radiation. In spite of very careful medical attention the child died of pneumonia at the age of five months.

The second case was first seen by the author when the patient was two years of age. This was a case of osteogenesis imperfecta tarda, which is also known as osteopsathyrosis or fragilitas ossium. Medical advice was sought because of inability to walk and susceptibility to fractures from insufficient causes. The family history revealed that the patient's father at the age of 12 years had sustained a fracture of his left elbow following a sufficient injury. At various times following this he suffered six fractures of the same elbow without sufficient injury. The father and the mother of the patient had strong suggestions of blue sclera. Physical examination of the patient revealed deep china-blue sclera and outward bowing of the legs. Roentgenograms revealed marked thinning, general atrophy, and increased radiability of the bones. The bone lamellæ appeared thin, delicate, and sparse. The tibiæ showed evidence of healed fractures. Blood chemistry revealed normal findings for calcium, phosphorus, and phosphatase, and the Wassermann test was negative. Therapy was directed to guarding him from injuries, and ultra-violet light treatment and viosterol were administered with the hope of increasing the resistance of his bones. He suffered fractures of the right and left tibiæ while under treatment, but they healed rapidly and completely.

J. N. ANÉ, M.D.

CALCULI

Sialolithiasis of the Maxillary Glands. Quintino Vischia. Arch. di radiol., 1934, **10**, 262–270.

Vischia presents clinical notes and the radiographs n three cases of salivary gland calculus, in all of which pain came on with the taking of food.

E. T. LEDDY, M.D.

DIAPHRAGMATIC HERNIA

Two Cases of Diaphragmatic Hernia. J. S. Beilin. Röntgenpraxis, April, 1934, **6**, 229–233.

A very large left-sided diaphragmatic hernia is the first case described, with the entire stomach and part of the colon in the left thorax. There was no clinical symptom pointing to the lesion. The etiology was traumatic.

The second case is that of a right-sided hernia, with partial displacement of the liver into the right thorax. This condition is rare. The patient had some dyspnea, and pain in the right thorax after an automobile accident. Roentgen examination showed portions of the colon and liver above the diaphragm.

H. W. HEFKE, M.D.

DOSAGE

The Radiotherapeutic Significance of Epitheliolysis, with Special Consideration of the Oral, Pharyngeal, and Laryngeal Carcinomas. J. Borak. Strahlentherapie, 1934, **51**, 480.

The author discusses at length the therapeutic principles underlying the protracted fractional dose method of Coutard. He objects to the term "radio-epithelitis" which implies an inflammation of the epithelium. As Rost has stated many years ago, there can be no inflammation of the epithelium of the skin because of the absence of blood vessels. The term "radio-epitheliolysis" is suggested in its place as well as the term "radio-epitheliolytic dose." If single doses do not exceed 300 r per field, it is not necessary to protract; simple fractional application at about 20 r per minute is permissible. Skin tests on a patient (photographs shown in the article) bear out the author's contention. During the period 1924–1927, twelve cases of carcinoma of the larynx, eight cases of carcinoma of the tonsil, and eleven cases of carcinoma of the oral cavity and pharynx were treated accordingly. Of the cases receiving epitheliolytic doses, 88 per cent became free from symptoms and 63 per cent remained free from recurrence for over a year.

ERNST A. POHLE, M.D., Ph.D.

THE ELBOW

Patella of the Elbow: A Contribution to Anomalies of the Skeleton. Kurt Kremser. Röntgenpraxis, June, 1934, **6**, 371–374.

The anatomical anomaly of a so-called sesmoid of the elbow or patella of the elbow has been described in only about ten instances. Trauma may be excluded when the olecranon process is entirely intact. The case reported by the author showed a large patella-like sesmoid proximal to the olecranon and apparently in the tendon of the triceps; there was a definite distinction between cortex and medulla. The bone was palpable and movable. To explain this anomaly on a traumatic basis seems not correct. The author believes that not only ossification in the tendons may explain this occurrence but also the formation of a true sesmoid.

H. W. HEFKE, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

Neglected Affections and Lesions of the Deep Urethra. Edgar G. Ballenger, Omar F. Elder, and Harold P. McDonald. Am. Jour. Surg., August, 1934, **25**, 201–210.

Attention is directed to the importance of more careful and well-timed studies of the prostatic urethra. The symptoms of disorders in this area are numerous but often are misleading; they are of value in directing to investigations which result in correct diagnoses.

The diagnosis is not difficult if studies are made with a good urethroscope.

If employed with reasonable skill and cystoscopic dexterity, the treatment of chronic affections and lesions of the deep urethra is generally quite satisfactory.

The high frequency current, cutting and fulgurating, and topical applications are the agencies usually employed.

DAVIS H. PARDOLL, M.D.

The Clinical Value of Bladder Pressure Estimations. Kenneth H. Watkins. British Jour. Urol., June, 1934, **6**, 104–118.

Observations upon the pressure within the normal urinary bladder are recorded. Two different types of bladder paralysis have been demonstrated as the result of pressure studies. Definite information upon the condition of the bladder innervation can be obtained by making careful pressure estimations. It is pointed out that most of this information can be derived by more simple clinical means.

DAVIS H. PARDOLL, M.D.

Pre-sacral Sympathectomy and the Urinary Bladder. E. D'Arcy McCrea and A. D. McDonald. British Jour. Urol., June, 1934, **6**, 119–127.

The sympathetic and parasympathetic nerves function together in the regulation of the bladder, and the parasympathetic are by far the more important. While the action of one or the other may be predominantly *excitor inhibitor*, yet it is not to be assumed that either is exclusively so, nor yet that they are antagonists. Both nerves transmit sensory impulses, the pathway by the pelvic nerves being the more important. The precise action of the hypogastric nerves on the vesical sphincters is not known nor is it known that the former have any influence at all upon them.

DAVIS H. PARDOLL, M.D.

A Review of 162 Consecutive Personal Cases of Stone in the Upper Urinary Tract. H. P. Winsbury-White. British Jour. Urol., June, 1934, **6**, 142–155.

The author reviews 162 consecutive cases of stone in the upper urinary tract, and cites his personal experience with this large series. The chief interest of these cases is the manner in which they illustrate the value of intravenous pyelograph in differentiating between the various lesions. When a perinephric abscess produces pressure on the upper end of the ureter, the radiologic appearance may be somewhat similar, but there is no deformity of the intrarenal portion of the pelvis unless there is some renal focus.

DAVIS H. PARDOLL, M.D.

GYNECOLOGY

Experience with Short Wave Therapy in Gynecology, Particularly in Tumors of the Adnexa. E. Vogt. Strahlentherapie, 1934, **51**, 526.

The author used short electric waves in the treatment of acute and chronic type of peritonitis, salpingitis, and also in gonorrheal infections. The results were very encouraging. A most striking cure was obtained in a patient with severe gonorrheal arthritis in the knee which healed with complete function.

ERNST A. POHLE, M.D., Ph.D.

HIP JOINT

Fractures of Neck of Femur, Dislocations of Hip, and Obscure Vascular Disturbances Producing Aseptic Necrosis of Head of Femur. D. B. Phemister. Surg., Gynec. and Obst., September, 1934, **59**, 415–440.

The vascular anatomy and the lack of collateral circulation about the hip is such that certain types of injury may, by damage of blood vessels, result in aseptic necrosis of a part or of all of the head of the femur. This is closely associated with non-union of the fracture, as shown by the author's statistics.

In the author's experience it has been possible to determine from roentgenograms in from two to five months in the great majority of cases, especially of non-union, whether the head has remained alive or has undergone partial or complete necrosis. This is based on the fact that in case of non-union atrophy of disuse of the living bone develops during the period of immobilization, while the dead bone of the head does not atrophy. Roentgenograms made after an interval of from two to three months will show the necrotic bone to be relatively more dense than the surrounding atrophied living bone.

It has been shown that connective tissue and blood vessels slowly invade the dead bone, which is then ab-

sorbed and replaced by new bone by the process of "creeping substitution." This process may take place over a period of months or years.

Traumatic dislocation of the hip severs the round ligament, which in some cases contains blood vessels supplying a portion of the head of the femur. This portion of the head undergoes aseptic necrosis unless there is an adequate collateral circulation in this region. If too extensive weight-bearing is allowed in these cases before the process of creeping substitution is completed, collapse of the head and permanent lameness of the hip result. The author reports one case each of necrosis and collapse of the head of the femur following fracture of the base of the neck with bone union and fracture of the greater trochanter. Other conditions in which aseptic necrosis occurs are as follows: Slipped femoral epiphyses during adolescence or late childhood; pathologic dislocations of the hip; congenital dislocations of the hip that are reduced by manipulation or operation; arthroplasty for the mobilization of ankylosed hips; Perthes' disease, and osteochondritis dissecans. Aseptic necrosis has been noted also in adults in whom there is no history of an etiologic factor. Causative factors that have been considered are trauma, embolism, obliterative vascular disease, constitutional and endocrine disturbances.

J. N. Ané, M.D.

THE INTESTINES

Benign Stricture of the Intestine Due to Irradiation of Carcinoma of the Cervix Uteri. E. N. Collins and Thomas E. Jones. Surg., Gynec. and Obst., October, 1934, **59**, 644–649.

The authors present six cases of benign stricture of the intestine which occurred in a series of 422 patients with cervical carcinoma treated by irradiation therapy. The recognition of this condition as a clinical entity is of great importance, for this curable lesion may be easily mistaken for metastatic carcinoma.

Five of the six cases of this group had received both radium and roentgen therapy, and one patient had had only radium therapy. In all cases tubes of radon having 1.5 mm. of brass filtration enclosed in 2 mm. of rubber were used, and the dose administered varied from 2,440 to 4,240 millicurie-hours. Roentgen therapy was administered through four portals—suprapubic, right iliopubic, left iliopubic, and post-sacral. Each portal received 50 per cent of a skin dose at a time, and the entire course in each case was given in from 5 to 7 days. The factors employed were: 200 K.V.; from 5 to 8 ma.; filtration, from 0.5 to 1.0 mm. of copper and 1 mm. of aluminum; focal skin distance, 50 centimeters. The skin unit dose was 800 r, the estimated 10 cm. depth dose was from 30 to 40 per cent, and the total calculated roentgen dose about the cervix was approximately 800 r.

The lesion found in these cases consisted of a localized, annular, fibrous thickening of the wall of the intestine, associated with a varying constriction of the lumen. It is believed that ulceration may or may not be present at the time the lesion is observed at operation.

The history of unusual intestinal symptoms, such as tenesmus, diarrhea, mucus and blood in the stools, for a period of three weeks or longer, immediately following irradiation therapy, is considered of significance in the diagnosis of this condition. With the formation of the stricture the patient complains of unusual constipation, followed by symptoms of intestinal obstruction. Because of the fixation by adhesions of the involved segment it may be impossible to examine the lesion by means of the sigmoidoscope. The colon roentgen examination is considered the most important single means of revealing the condition. An annular filling defect, somewhat similar to the appearance of an infiltrating carcinoma, is noted if the obstruction is not complete. However, in the case of the benign stricture the defect is hour-glass in appearance, and, although small, is fixed in position and presents a more gradual line of demarcation between the normal and abnormal tissue than is usually seen in malignancy.

Since it is believed that irradiation stricture may develop in a localized segment of intestine because this segment, during radium irradiation, remains constantly adjacent to the area being treated, the lesion should be prevented if the position of this segment can be changed at intervals during the time the radium is in place. The authors advise, therefore, changing the position of the patient at intervals from the usual horizontal to the Trendelenburg position when the radium is placed high in the fundus. During the cervical application the moderate Trendelenburg position should serve to separate the intestine sufficiently from the radium. The use of pitressin, administered after the usual thorough emptying of the intestine to stimulate continued intestinal peristaltic activity, and the colon tube, to prevent the accumulation of gas, are also suggested.

J. N. Ané, M.D.

THE KIDNEYS

Carbuncle of the Kidney. Joseph A. Lazarus. Am. Jour. Surg., July, 1934, **25**, 155–162.

The author reports eight cases of carbuncle of the kidney. In his series, five occurred in females. He draws the following conclusions:

Carbuncle of the kidney is a distinct clinical entity. In 75 per cent of the cases the right kidney was involved.

A history of pain and tenderness in the lumbar region, accompanied by fever and loss of weight, with a scarcity of urinary symptoms, especially when following a carbuncle or furuncle elsewhere in the body, is extremely suggestive of this condition.

Cystoscopy offers little aid in diagnosis. Roentgenologically an effacement of the psoas margin, with an enlargement of the renal silhouette on the affected side is very suggestive of this disease. Absence of the psoas margin was noted in all cases of this group, while an enlarged renal silhouette was seen in 50 per cent of them.

A bulging in the flank was noted in all. Since perinephritic abscess so frequently accompanies carbuncle of the kidney (87.5 per cent in this series), it is encumbent upon the surgeon when operating for a perinephritic abscess to carefully explore the kidney in order to rule out a possible co-existing carbuncle.

The lesion is usually produced by an organism of attenuated virulence of the staphylococcus group. Extreme conservatism is indicated in treating these cases. The procedure of choice, as noted in this series of eight cases, is simple incision and drainage. Nephrectomy should be reserved only as a procedure of last resort.

Wound dakinization has proved an extremely valuable means of curtailing post-operative convalescence. The prognosis is good, especially when intervention is instituted early.

DAVIS H. PARDOLL, M.D.

Wilms Tumor of the Kidney. Samuel J. Sinkoe, Major F. Fowler, and Louis Berger. Am. Jour. Surg., July, 1934, **25,** 163–169.

The authors wish to emphasize certain facts in connection with their case, which verify the findings of other clinical investigators. A diagnosis should be made as early as possible and proper therapy immediately instituted. Recognition of renal pathology due to neoplastic involvement is not difficult with the aid of a complete urologic study. Early operative interference offers the best prognosis. If the tumor is found to encroach upon adjacent vital structures, the outlook is not favorable, due to surgical shock and frequency of recurrence. The curative value of the x-ray and radium is questionable when they are used alone; however, in conjunction with surgery, they may be of considerable value.

DAVIS H. PARDOLL, M.D.

THE LUNGS

The Diagnosis and Treatment of Pulmonary Abscess in Children. David T. Smith. Jour. Am. Med. Assn., Sept. 29, 1934, **103,** 971–974.

Pulmonary abscess is not diagnosed as frequently in children as in adults probably because it occurs less commonly and is more difficult to differentiate from other pulmonary infections. Among 2,250 cases of lung abscess collected from the American literature, only 59 were in infants and children. Among 2,119 patients admitted to the pediatric service of the Duke Hospital, seven had pulmonary abscess. Thirty-nine cases collected from the literature have been analyzed for predisposing causes, supplemented by six previously reported from the Duke Hospital. Twenty-four followed pneumonia, 13 followed tonsillectomy, one followed aspiration of a foreign body, one followed exposure, and one followed aspiration of a membrane in a case of Vincent's angina.

There are four possible routes by which the infecting material may reach the lung. It may be introduced directly by a penetrating wound, it may drain in through the lymphatics, it may enter through the blood stream as an embolus, or it may be aspirated. Cutler and his co-workers believe that most, if not all, of the abscesses following operations are embolic in origin. Certainly those following aspiration of a foreign body must reach the lungs through the air passages and those which follow pneumonia are logically explained by the same mechanism. Abscesses that follow operation in sterile fields, which remain sterile, are best explained by the aspiration of infected material while the patient is under an anesthetic. It is Cutler's opinion that the majority of cases which follow operations on the tonsils and other structures in the upper respiratory tract are also due to simple aspiration.

In children, as in adults, pulmonary abscesses can be divided on the basis of etiology into (1) bacterial abscesses, (2) fusospirochetal abscesses, and (3) fungous abscesses. As a rule the bacterial abscesses are not gangrenous while the fusospirochetal abscesses, whether diffuse through one or more lobes or limited to a small area in one lobe, are always gangrenous. The common bacteria that produce abscesses are staphylococci, Friedlander's bacilli, certain streptococci, Bacillus pyocaneus, Bacillus influenza, and the members of the gas gangrene group of bacilli. The souce of the mixture of organisms which is responsible for the fusospirochetal type of abscess is generally the gums or the tonsils of the patient, although occasionally it may be contracted from another individual.

The history, physical signs, and x-ray shadows may be identical in cases of bacterial abscess, fusospirochetal abscess, and mycotic abscess. The final diagnosis rests entirely on a study of the pulmonary secretions. Exploring the lung with a needle in search of an abscess is contra-indicated because of the danger of producing empyema.

The general supportive measures, such as rest in bed, forcing of fluids, high vitamin diet, and postural drainage can be equally well applied to all types of pulmonary abscess. Bacterial abscess of the gas gangrene group should be treated with specific or polyvalent antigangrene serums. The acute staphylococcic abscesses might be treated with new staphylococcus antitoxin. Abscesses due to other bacteria should be treated palliatively in the acute stage unless empyema develops. If the lesion persists for three months, it has reached the chronic stage and should be treated by open operation and drainage. The fusospirochetal type should be diagnosed and arsenic treatment started within the first two weeks if the best results are to be obtained.

The mycotic abscesses of the lung should be treated by gradually increasing doses of potassium iodide.

CHARLES G. SUTHERLAND, M.D.

Syphilitic Gumma of the Lung: Case Report. Eugene Freedman and Charles S. Higley. Am. Jour. Roentgenol. and Rad. Ther., March, 1934, **31,** 333–339.

Referring to a recent review of the literature, the authors state that between the years 1854 and 1920 only 48 cases of pulmonary syphilis with autopsy verification have been reported in the literature.

The patient, a woman of 36 years of age, was ad-

mitted to the hospital complaining of abdominal enlargement, swelling of the legs, jaundice, and a nonproductive cough with slight dyspnea of short duration. She had had five miscarriages: there were four living children. Chest examination showed dullness and crepitant râles at the right base, and a soft systolic murmur at the apex. The spleen and liver were both enlarged. The blood Wassermann was four plus. X-ray examination showed a dense clouding in the right lower lung, obliterating the diaphragm, which was attributed to atelectasis of the middle lobe. Also there was seen in the apex of the lower lobe an oval density measuring about 8 by 3 centimeters. Under antisyphilitic therapy the clouding partially cleared but the nodule remained unchanged. Shortly before death the patient developed râles in both lungs and a fever of 39.5° C. She died on the fiftieth day after admission. A clinical diagnosis of pulmonary syphilis had been made by ruling out tuberculosis and malignancy. At postmortem examination the gummatous mass in the inner upper portion of the right lower lung was found to be typical grossly and microscopically of syphilis. There were also scattered areas of fibrosis in the liver.

When syphilis attacks the lungs there may occur an interstitial fibrosis (commonest form), single or multiple gummatous masses, or diffuse lobar pneumonia (affecting infants chiefly). The gummatous lesions are more apt to respond to treatment than are the interstitial ones.

J. E. HABBE, M.D.

LYMPHATIC SYSTEM

A Roentgen Study of the Absorption by the Lymphatics of the Thorax and Diaphragm of Thorium Dioxide Injected Intrapleurally into Animals. L. J. Menville and J. N. Ané. Am. Jour. Roentgenol. and Rad. Ther., February, 1934, **31,** 166–172.

These workers were the first to visualize by roentgenologic methods the various portions of the lymphatic system by means of injection of thorium dioxide subcutaneously, intradermally, and intrapleurally, intraperitoneally, intrapericardially and intracardiacly, both in laboratory animals and in selected human subjects. Laboratory animals included rats, dogs, and rabbits. All cases examined were first radiographed, then injected with the contrast medium, and then studied both fluoroscopically and by serial roentgenograms at 24-hour intervals.

The first portion of the lymphatic system to be visualized following intrapleural injection was the sternal group of glands, this occurring within an hour after injection, hence the writers conclude that the first absorption was through the parietal pleura. Lymph vessels were visualized on both sides of the chest following injection into one side only, thus clearly indicating the presence of connecting vessels between the two sides. The diaphragm of all laboratory animals absorbed thorium in greater quantities when the injections were intraperitoneal than when intrapleural. Following intraperitoneal injection of thorium dioxide into a human being, visualization of both abdominal lymph vessels and glands and of thoracic glands was obtained.

J. E. HABBE, M.D.

THE OVARIES

Our Results in the Treatment of Carcinoma of the Ovary. C. Schroeder. Strahlentherapie, 1934, **51,** 465.

Fifty-six cases (histologically proved) of carcinoma of the ovary were seen in the author's clinic from 1923 to 1929. A cure was obtained in 32.1 per cent. If arranged according to type of treatment it appeared that laparotomy plus irradiation cured 9 per cent, incomplete operation and irradiation 25 per cent, and radical operation plus irradiation 60 per cent. Patients who had laparotomy, complete operation, or no operation at all received 1,800 r (in the depth) during a period of 14 days. Patients who had incomplete operation received a total of 900 r (in the depth) given in 11 days.

ERNST A. POHLE, M.D., Ph.D.

PERITONEUM, TUBERCULOUS

Our Method of Roentgen Therapy of Tuberculosis of the Genital Organs and Peritoneum in Women. C. J. Gauss. Strahlentherapie, 1934, **51,** 371.

The author reports his experience regarding roentgen therapy of tuberculous peritonitis in women. Of 40 cases treated in his clinic, only 25 could be traced. Technic: K.V.(?); 1 mm. Cu + 1 mm. Al; 20 × 24 cm. over anterior lower abdomen at 50 cm. F.S.D. Every six weeks decreasing surface doses were given: 120, 100, 80, 60, and 40 r. Eighteen patients responded well to the treatment: four were improved and three only temporarily benefited. The menstruation was not disturbed in the majority; however, no pregnancies occurred. The importance of an accurate diagnosis is emphasized; if necessary, laparotomy should be performed to establish the diagnosis.

ERNST A. POHLE, M.D., Ph.D.

THE PROSTATE

Roentgen Treatment of Benign Hypertrophy of the Prostate Gland. Benjamin S. Barringer, Archie L. Dean, Jr., Ralph E. Herendeen, and James J. Duffy. Am. Jour. Roentgenol. and Rad. Ther., March, 1934, **31,** 350–355.

Thirty-four patients with benign prostatic hypertrophy have been given adequate trial deep x-ray therapy and followed for a sufficiently long time to permit the observers to determine their end-results. Twenty-three of these 34 men had a residual urine of 60 c.c. or more; the others, less than 60 c.c. The former group would include those for whom prostatectomy would be advised by most urologists. Seven of these 23 cases showed improvement of symptoms, with the residual urine being decreased to little or none. This percentage of successful results represents fairly well,

in the opinion of the authors, just about what can be accomplished by roentgen therapy.

Histologic changes occurring in the hypertrophied prostate are numerous and varied, of which lymphocytic infiltration, congestion and edema, and smooth muscle tissue and epithelial overgrowth are unstable factors which might respond to radiation therapy.

In most instances the patient was studied to determine accurately the amount of residual urine, then treated by catheterization, irrigation, massage, and internal medication to the point of maximum benefit, after which he was referred to the roentgenologist to determine how further improvement could be accomplished by him. Ordinarily three fields were used: suprapubic, perineal, and sacral, about 200 r being given to one portal every other day until the three portals had each been irradiated once, then at about ten-day intervals. A second, third, and even fourth series may be given. Since the accumulated depth dose is only about 34 per cent of an erythema dose, per cycle, it is believed that beneficial results are primarily due to decrease and control of the edema in the gland. It also seems probable from study of the good results achieved in this group of cases that the "simple bilateral lobe hypertrophy" described by Randall is the type best suited to this form of treatment.

J. E. Habbe, M.D.

RADIATION EFFECTS

Fundamental Principles of Pre-operative Irradiation. O. Jüngling. Strahlentherapie, 1934, **51,** 393.

The author discusses briefly the indications for pre-operative irradiation as practised in his clinic. He feels that pre-operative exposure of a tumor is not only a therapeutic but also a diagnostic method, since it offers an opportunity to determine the radiosensitivity of a neoplasm. There are no serious contra-indications to pre-operative irradiation; the operation is not rendered more difficult nor is there any disturbance of the healing of the wound.

Ernst A. Pohle, M.D., Ph.D.

RADIOLOGY, PRACTICE OF

Radiology as an Aid to the General Practitioner. E. Kaye Le Fleming. British Med. Jour., Sept. 8, 1934, pp. 462–464.

Speaking as a general practitioner, the author believes that the closest contact and co-operation between the radiologist and the general practitioner is necessary. The science of radiology is technically outside the sphere of the knowledge of the general practitioner and is advancing so rapidly that the busy general practitioner cannot keep pace with it. Because of the expense of radiologic examination and irradiation therapy, there is often some hesitancy in recommending an expensive form of examination or treatment without good knowledge of its nature and its probable efficacy. Therefore, there is a danger that the tie between radiologist and general practitioner may become weakened or even lost, to the disadvantage of all concerned. The solution of this problem depends upon co-operation among radiologists in the study of their results, and the systematic presentation of these results to the general practitioner who seeks them.

The author discusses the use of the x-ray in the diagnosis and treatment of the most common conditions in which he seeks aid from the radiologist.

J. N. Ané, M.D.

THE SPINE

The Oblique View for Demonstration of the Articular Facets in Lumbosacral Backache and Sciatic Pain. Ralph K. Ghormley and B. R. Kirklin. Am. Jour. Roentgenol. and Rad. Ther., February, 1934, **31,** 173–176.

It is important that all patients complaining of back pain with sciatic radiation be studied carefully as to the small joints formed between the adjacent facets of the fifth lumbar and the first sacral vertebræ. This cannot be done well roentgenologically by anteroposterior and lateral examinations only, even when stereoscopy is employed, but by rotating the patient into an anteroposterior oblique position and using an angle of about 32 degrees from the horizontal, these joints can be clearly demonstrated and narrowing of joint space, marginal proliferation of bone, facet fractures, and anomalous development may be shown. It is the authors' belief that in cases in which there develops sudden sharp pain low in the back, with or without sciatic radiation, and in which relief is accomplished by manipulative procedures, the seat of the trouble is more probably in these small articulations or their facets than in the ligaments alone.

J. E. Habbe, M.D.

THE STOMACH

The Cascade Stomach. Werner Kaufmann. Röntgenpraxis, June, 1934, **6,** 345–355.

Cascade stomach has been explained by many different theories. According to the observation of the author this anomalous behavior of the stomach is usually caused by constitutional factors and is seen most frequently in stout persons, when the stomach is forced into a more or less horizontal position not much below the diaphragm. There are, however, some other causes for it: extrinsic pressure on the stomach by an accumulation of fat in the region of the tail of the pancreas, or, in thin persons, an accumulation of gas in the left colon. Gaseous distention of the stomach itself is of importance also; the air swallowed during eating expands the cardiac end of the stomach which tends to become as round as a balloon. Adhesions which pull the pyloric end of the stomach toward the right (cholecystitis, duodenal ulcer, etc.) may cause the same phenomenon. The cascade deformity of the stomach is constant in the constitutional type (stout persons with good abdominal muscles); it is not constant in cases in which a gas-filled colon causes it. This colonic gas is usually not due to fermentation and indigestion, but, rather, to hydrostatic pressure. Some

of the symptoms of cascade stomach with excessive gas in the stomach and colon may be improved by reducing the amount of fat in the abdomen (diet), and by the patient taking abdominal and diaphragmatic exercises. In thin individuals with relaxed abdominal muscles, gain in weight, exercise, and an abdominal support will achieve results.

H. W. HEFKE, M.D.

THE TESTES

The Function of the Testes after Puberty. T. E. Hammond. British Jour. Urol., June, 1934, **6,** 128–141.

It has been held for years that without testes no spermatozoa could be formed, and without spermatozoa no impregnation could take place; this still holds true. The functions attributed to the internal secretion is based on erroneous deductions.

The internal secretion is probably essential for the true development of the secondary sexual characters. When once these are formed, removal of the glands leads to very little change, though shaving need not be so frequently performed.

It has some action in stimulating sexual desire and power. After castration both persist but to a lessened degree, and tend to disappear at an earlier age. The internal secretion probably has some action upon metabolism, as shown by the tendency to put on fat after castration. It may also have some action upon that elusive condition known as general tone. The secretion certainly has not that action upon the mental and physical well-being which has in recent years been claimed for it.

DAVIS H. PARDOLL, M.D.

THYROID (THERAPY)

Observations on Irradiated Cases of Thyrotoxicosis. W. Lahm. Strahlentherapie, 1934, **51,** 382.

During 1932 and 1933, 110 cases of thyrotoxicosis received roentgen therapy in the author's clinic. Only patients with a basal metabolic rate above +20 are analyzed in this report. Technic: 100–150 r over the thyroid and thymus once a week up to 700 r total dose. The spleen received 200 r if enlarged. The hypophysis was also treated occasionally by applying 150 r over a left and a right temporal field. Ovarian irradiation was sometimes given. The results were very gratifying; as indicators for improvement the author uses the weight and the subjective symptoms, particularly heart symptoms, and also the basal metabolic rate. In men, the disease seems to take a more severe course and is more difficult to influence than in women.

ERNST A. POHLE, M.D., Ph.D.

TONSILS

Ten Years' Experience with Roentgen Therapy in Non-malignant Disease of the Tonsils in Over One Thousand Patients. G. Schulte. Strahlentherapie, 1934, **51,** 365.

During the period 1924–1934 the author treated over a thousand cases of chronic tonsillitis with roentgen rays. Technic: 180 KV.; 1 Cu + 1 Al; 6 × 8 cm. field; 30 cm. F.S.D., 175 r over left and right cervical area, central ray directed to angle of jaw. If the treatment was tolerated well, two fields were applied on one day. Treatment was repeated after four and, if necessary, after eight weeks. In children, 140 KV., filtered through 4 Al, and a total of 135 r usually suffices. The results were excellent; 86.1 per cent were cured, 11.9 per cent improved, and 2 per cent did not derive any benefit from the treatment. Seven of the latter cases were operated on. The author believes that if cases are carefully selected, even better results may be expected. The advantages of irradiation as compared with operation are briefly discussed.

ERNST A. POHLE, M.D., Ph.D.

TUMORS (DIAGNOSIS)

Endothelial Myeloma: An Analysis of Cases. Willis C. Campbell. Jour. Bone and Joint Surg., October, 1934, **16,** 761–780.

The author analyzes 23 cases which presented factors more or less suggestive of endothelial myeloma. Of these, 11 cases were classified by the Registry of Bone Sarcoma of the American College of Surgeons as endothelial myeloma, and three cases as unclassified sarcoma. Six cases of endothelial myeloma were not submitted to the Registry of Bone Sarcoma, and in three the final diagnosis of the bone pathology was inflammation.

Roentgenographic examination of the 17 cases of endothelial myeloma showed that there were 11 tumors in the shaft of the long bones, two near the ends of the long bones, one on the end of the bone, one in the ilium, one in a rib, and one in the pubic bone. Four of the 17 patients had had operations for acute osteomyelitis. Four cases gave a history of sudden onset and in only one of these was the patient treated for osteomyelitis.

Five of the 11 registered cases had x-ray treatment and Coley's toxins and of these three are living and well, 7, 4, and 3 years, respectively, after treatment. However, two of these three patients also had amputation in addition to x-ray therapy and toxins. X-ray treatment was employed in two cases, with improvement in both. This was more marked in the patient who lived four and one-half years after treatment.

The symptoms of intermittent pain, with swelling, found in Ewing's tumor, is also seen as a result of syphilis, osteomyelitis of Garré, subacute and low-grade osteomyelitis and osteogenic sarcoma. In syphilis, the Wassermann reaction and the roentgenographic demonstration of the bone changes will help in the differentiation. In Garré osteomyelitis there is often a history of a sudden onset, with a slight elevation of temperature, but no recurrent attacks. The bone changes of Garré osteomyelitis consist of condensation and spindle-shape enlargement, with proliferation of the periosteum. In the early stage of Ewing's tumor there is condensation, but no expansion. In the second stage there is proliferation of the periosteum, with destructive changes in the shaft.

The differentiation of acute infectious osteomyelitis and Ewing's tumor is of great importance. In acute

infectious osteomyelitis, the onset is sudden, with no previous local symptoms. In this condition the temperature is high, with a marked increase in the total white cells and in polymorphonuclear neutrophils. In the early stage of Ewing's tumor the temperature is usually about from 99 to 100 degrees, although it may be higher. While there may be a moderate increase in the total white cell count the differential count is usually about normal. The roentgenogram is of great value in the diagnosis, for in acute pyogenic osteomyelitis the x-ray examination is negative at the onset and remains negative for from two to four weeks. In Ewing's tumor, however, there are always structural changes in the bone by the time the symptoms are apparent. The histologic examination of a section will reveal the presence of tumor in Ewing's, while the presence of organisms can be demonstrated by cultural methods in acute osteomyelitis. Differentiation of these conditions may be difficult, however, in a case of Ewing's tumor in which there has been an operation followed by a draining sinus. X-ray therapy is likewise of value in the differentiation of these conditions, for in Ewing's tumor a marked, rapid recession of the tumor will be noted while it will have no effect in a case of acute osteomyelitis.

The differentiation between osteogenic sarcoma and Ewing's tumor depends upon the history and the x-ray examination. The rapidly growing osteolytic type of osteogenic sarcoma which results in destruction of the entire bone may appear similar to the third stage of Ewing's tumor after disintegration of the reactive bone layers of the periosteum has occurred. Irradiation therapy will prove of value in the differentiation, as osteogenic sarcoma does not respond to irradiation. Metastatic carcinoma may closely resemble Ewing's tumor as demonstrated by Hirsch and Ryerson in the case of a boy, six years old, with primary carcinoma in the bronchi.

J. N. Ané, M.D.

The Results of Examination of the Petrous Bone in Auditory Nerve Tumors. Bertil Ebenius. Acta Radiologica, 1934, **15**, 284–290.

This communication deals with the x-ray findings of 34 cases of acoustic tumors, all of which were verified at operation at the Royal Seraphimer Hospital, in Stockholm, during the period 1929–1933. In order to estimate the value of the x-ray signs, careful study of the normal variations was also made, 100 clinically normal heads being similarly radiated. As to projections, the author believes the frontal-dorsal (occipital) and axial or submental-vertical to be the only satisfactory and reliable ones: the latter view should project the angles of the mandible just anterior to the petrous apices. It is also emphasized that the films should be slightly overexposed for best recognition of pathologic details. In the 100 normal skulls the width of the internal acoustic meatus varied from 5 to 9 mm. (average, 6.3 mm.) on the fronto-dorsal film, and from 4 to 8 mm. (average, 5.7 mm.) on the axial film, using a 74.5 cm. target-film distance and a 3.5 cm. table-surface-film distance. (Film calculations 25 to 28 per cent increased over actual.) A difference of 1 mm. or more in the width of the opening was encountered in 59 per cent of the normal cases. In 80 per cent of the proven tumor cases an expansion deformity of the canal is of more diagnostic importance than mere expansion of the orifice. Usually decalcification of the petrous bone accompanies the canal changes (58.8 per cent of these cases). Of the seven cases which showed no canal changes, five revealed areas of destruction in the petrous apex and dorsum sellæ, thus localizing the tumor in the cerebello-pontine angle. The other two cases gave signs of increased intracranial pressure only. Hence there were no cases with entirely negative x-ray findings in the entire series of cases by this method of study.

J. E. Habbe, M.D.

TUMORS (THERAPY)

A Lymphosarcoma of the Stomach and its Cure by Roentgen Therapy. R. Kaiser. Röntgenpraxis, April, 1934, **6**, 233, 234.

An interesting case of lymphosarcoma of the stomach and an apparent eight-year cure are described. In 1926 a large tumor of the stomach was diagnosed by roentgen examination. At operation, an inoperable malignant tumor was found in the posterior wall; a biopsy proved the tumor to be a lymphosarcoma. Roentgen therapy was begun after operation, as the only possible chance for the patient. The tumor itself received about 70 per cent of an S. E. D. from anterior and posterior fields. The treatment was repeated three times at intervals of three months. One year afterward there was no palpable tumor, the patient had gained 30 pounds and felt well. Another examination in 1934 revealed no pathology clinically nor roentgenologically.

H. W. Hefke, M.D.

Irradiation Treatment of Malignant Intrathoracic Tumors. F. G. Chandler, N. S. Finzi, and James Maxwell. British Med. Jour., Oct. 20, 1934, pp. 714–717.

The authors review a group of 70 cases of malignant intrathoracic tumors treated by irradiation therapy, and analyze the results obtained with this form of treatment. In the study of these cases microscopic examination of a section of the thoracic growth or of a metastasis was considered of greatest diagnostic importance. The material for examination was obtained by thoracotomy in seven cases, by bronchoscopy in seven, by removal of a metastasis in five, and from postmortem material in 19 cases. Careful and thorough clinical and roentgenologic examinations were obtained in all cases, and no doubtful cases were included in this series.

Of the 70 cases of intrathoracic tumors, there were 44 of bronchial carcinoma treated by the x-ray with the following results: Twenty-three cases showed marked relief of symptoms, with an average duration of life after beginning treatment of 9.7 months; seven cases

showed incomplete but definite relief of symptoms, with an average duration of life of 8.6 months; fourteen cases showed no change in condition of the patient after treatment and had an average duration of life of 5.4 months. In ten cases of bronchial carcinoma in which radium or radon was introduced directly into the growth through a bronchoscope the average duration of life after the operation was 2.4 months. In two cases radium was inserted into the tumor through the chest wall. One case showed marked temporary diminution of the tumor and in the other patient a decided improvement was noted for a few months.

The nine cases of malignant tumors other than bronchial carcinoma included the following: Secondary hypernephroma, primary sarcoma, secondary sarcoma, secondary carcinoma, and endothelioma from the thymus. In four cases of this series treatment had little or no effect; in two cases hemoptysis was apparently controlled, and in one case the intrathoracic growth was seen to diminish in size. The two remaining cases, which were diagnosed as endothelioma from the thymus and secondary carcinoma from the thyroid, are alive 11 and 21 years, respectively, after treatment.

The remaining five cases presented in detail by the authors include those in which both the clinical picture and the x-ray appearance suggested malignant tumor but in which no histologic proof of the nature of the mass was obtained. In all of the cases of this group either cure or great relief has occurred.

J. N. ANÉ, M.D.

THE UTERUS

Radiation Therapy of Uterine Carcinoma. F. Voltz. Strahlentherapie, 1934, **51,** 453.

The author analyzes further the results obtained at the Women's Clinic, University of Munich, in radiation therapy of uterine carcinoma. From 1913 to 1928, 2,202 patients were admitted, 2,039 were treated, and 395 were cured (17.9 per cent). The respective result in early cases (Group I) was 45.1 per cent. A comparison with the cases treated in 1927 or 1928, with more efficient technic, shows that the total percentage of cure amounted to 22.6 per cent. In carcinoma of the fundus the percentage of cure amounted to 40.6 per cent in cases seen during the period from 1913 to 1928.

ERNST A. POHLE, M.D., Ph.D.

Intravaginal Irradiation at Close Range of Carcinoma of the Cervix. H. Martius. Strahlentherapie, 1934, **51,** 477.

It is a recognized fact that carcinoma of the cervix can be treated adequately by locally applied radium but that the peritoneum does not receive a sufficient amount of radiation. The author recommends for this purpose the new "body cavity x-ray tube" developed by Schaefer and Witte. With proper technic it is possible to get as much as 4,000 r to the pelvic wall without producing injury. There is very little systemic reaction, an observation which may be explained by the fact that only a small volume of tissue is irradiated.

ERNST A. POHLE, M.D., Ph.D.

The Development of Radiation Therapy of Uterine Carcinoma. A. Lacassagne. Strahlentherapie, 1934, **51,** 417.

The author gives a brief history of the development of the technic in radiation therapy of uterine carcinoma. The method practised in the leading clinics in the entire civilized world are briefly discussed. A very complete bibliography is appended to the article.

ERNST A. POHLE, M.D., Ph.D.

Supplementary Radium Treatment in Roentgen Therapy of Uterine Carcinoma. H. Wintz. Strahlentherapie, 1934, **51,** 441.

For the last twenty years the author has treated with roentgen rays alone most of the cases of uterine cancer seen in his clinic. He compares his statistics with those of other clinics using a combined roentgen and radium therapy, and concludes that only patients treated with insufficient quantities of roentgen rays should have intra-cervical or intra-uterine radium application.

ERNST A. POHLE, M.D., Ph.D.